LOW BLOOD PRESSURE

There is no target BP in HF-rEF

An asymptomatic systolic blood pressure (SBP) of 90-100mmHg, or diastolic blood pressure (DBP) of 50-60mmHg, usually requires no change.

Orthostatic BP Readings

Orthostatic BP readings can help identify individuals who may be at risk of orthostatic hypotension. Take the patient's BP while sitting or lying down. Then have the individual stand for 1 to 3 minutes & take their BP again. If the patient has orthostatic hypotension, i.e. a decrease in SBP of ≥20mmHg or DBP of ≥10mmHg: reassess diuretic(s), & consider starting with low HF-rEF medication doses & titrate slowly.

SYMPTOMATIC HYPOTENSION

if **SYMPTOMATIC hypotension** (i.e. low SBP + syncope, presyncope, dizziness, lightheaded, confusion, &/or blurred vision) that does not resolve with rising slowly:

- reassess other medications which ↓ BP but do not ↓ mortality/HF hospitalizations:
  - **diuretics**: reduce dose or discontinue to maintain an euvolemic state
  - **nitrates** for CAD: ↓ the dose or discontinue if patient has no chest pain
  - **calcium channel blockers**: reduce the dose or discontinue
- separate the administration of medications which ↓ BP, e.g. dose once daily ACEI or ARB in the morning & β-blocker HS (or both at HS balance against risk of falls overnight); split daily medications into BID (e.g. bisoprolol); dose α-blockers (e.g. tamsulosin) at HS
- if the patient is on **carvedilol**:
  - encourage administration with food, which will reduce the rate – but not extent, of absorption & ↓ the risk of orthostatic hypotension
  - consider switching to a cardioselective HF β-blocker (i.e. bisoprolol or metoprolol) as these ↓ BP less (carvedilol 12.5mg BID = bisoprolol 5mg daily = metoprolol SR 100mg daily)
- if the above does not address the concerns with symptomatic hypotension, reduce or hold doses of HF medications that lower BP; rechallenge if clinically appropriate (e.g. hypotension caused by acute illness); if unable to tolerate the lowest ARNI (i.e. **ENTRESTO**) dose, switch back to ACEI or ARB as **ENTRESTO** ↓ BP more
- if unable to tolerate target dose, document maximum tolerated dose & reason why

ASYMPTOMATIC HYPOTENSION

- encourage the patient to monitor their BP at home & to report symptomatic hypotension (i.e. low SBP + syncope, presyncope, dizziness, lightheaded, confusion, and/or blurred vision)
- counsel the patient re: there is no target BP

OTHER WAYS TO OPTIMIZE HF MEDICATION

- spironolactone / eplerenone: at recommended HF doses (25mg to 50mg daily), have minimal impact on BP – unless BP is elevated; 25mg daily for both are similar to placebo for lowering BP
- dapagliflozin 10mg [DAPA-HF] & empagliflozin 10mg [EMPEROR-Reduced] ↓ SBP by ~1-2mmHg vs placebo; reassess diuretics if symptomatic hypotension occurs
- if clinically appropriate, consider digoxin or ivabradine [LANCORA]

LOW HEART RATE

A resting HR of 50-60bpm is considered a reasonable target, provided the patient is not experiencing symptomatic bradycardia. If the patient has a pacemaker, it will be set at specific thresholds to prevent bradycardia (and tachycardia).

SYMPTOMATIC BRADYCARDIA

if **SYMPTOMATIC** bradycardia (i.e. HR lower than 60bpm + syncope, presyncope, fatigue, dizziness, lightheaded, confusion, and / or blurred vision):

- reassess medications which lower HR, while trying to maintain the β-blocker dose as β-blockers ↓ the risk of mortality & HF hospitalizations:
  - amiodarone, diltiazem, & verapamil: may worsen HF
  - ivabradine & digoxin: only ↓ HF hospitalizations (i.e. no mortality benefit)
- dose once daily β-blockers at bedtime balance against risk of falls overnight
- if the patient is on **carvedilol,** encourage administration with food, which will reduce the rate – but not extent, of absorption & ↓ the risk of bradycardia
- if the above does not address concerns with symptomatic bradycardia, reduce or hold the β-blocker; rechallenge if clinically appropriate
- if unable to tolerate target dose, document maximum tolerated dose & reason why

ASYMPTOMATIC BRADYCARDIA

- encourage the patient to monitor their HR at home & report symptomatic bradycardia (i.e. HR lower than 60bpm + syncope, presyncope, fatigue, dizziness, lightheaded, confusion, &/or blurred vision)
- if concerned about the risk of symptomatic bradycardia, increase the dose slowly in small increments; the evening dose of BID beta-blockers can be titrated first (e.g. carvedilol 3.125mg in the AM & 6.25mg HS x 2 weeks, then carvedilol 6.25mg BID)

OTHER WAYS TO OPTIMIZE HF MEDICATION

ACEI / ARB / ARNI, MRA & SGLT2i will not ↓ HR

β-BLOCKER ASSOCIATED FATIGUE / WORSENING OF HF SYMPTOMS

- when initiating or titrating a β-blocker, delay reducing / discontinuing diuretics if patient euvolemic due to potential transient fluid retention; if congestion ↑, add or ↑ diuretic
- if congestion or marked fatigue attributed to the β-blocker continues, reduce the β-blocker by half; rechallenge if clinically appropriate and if unable to titrate further, document as maximally tolerated dose & why
- if a patient subsequently undergoes revascularization for CAD (e.g. CABG, PCI), consider titrating the β-blocker again as fatigue may have been due to the underlying CAD

ARNI=angiotensin receptor neprilysin inhibitor (i.e. **ENTRESTO**) **MRA**=mineralocorticoid receptor antagonist (e.g. spironolactone) **RAAS**=renin angiotensin aldosterone system **SGLT2i**=sodium glucose co-transporter 2 inhibitor (e.g. dapagliflozin)

HYPERKALEMIA

Several HF medications (RAAS inhibitors: ACEI, ARB, ARNI & MRA) can increase K^+. A potassium level as high as 5.5mmol/L is often acceptable. Individuals with diabetes, elderly, and / or renal impairment are at increased risk of hyperkalemia.

HYPOKALEMIA

- taper diuretic to euvolemic state
- ↑ ACEI / ARB / ARNI, if possible
- start or titrate MRA
- correct hypomagnesemia (e.g. MgO_2 250-500mg daily), if present
- start K^+ supplement until K^+ within range (≥3.5mmol/L); longer-term use if required to maintain levels with frequent reassessment

TIPS WHEN INITIATING RAAS INHIBITORS (ACEI, ARB, ARNI, MRA) TO REDUCE THE RISK OF HYPERKALEMIA

- encourage a low potassium diet if K^+ greater than 5mmol/L (see BC's Food Sources of Potassium patient handout)
- check K^+ at baseline, and 1 to 2 weeks after starting or titrating these medications
- stop or reduce potassium supplements; consider baseline K^+, furosemide dose, & history of hypokalemia without supplements
- inquire about the use of salt substitutes and vitamin electrolyte replacements (e.g. some **EMERGEN-C** powder have K^+ 194mg/dose)
- ensure the patient is not using NSAIDs / COX-2 inhibitors, as these ↑ K^+, cause fluid retention, ↑ SCr, etc
- avoid combining an ACEI & ARB → ↑ risk of adverse events, including hyperkalemia; other combinations preferred (e.g. ACEI + MRA, ARB + MRA, or ARNI + MRA)
- when possible, avoid combining ACEI, ARB, ARNI or MRA with other medications which increase K^+, even if short courses of therapy (e.g. trimethoprim)
- monitor for hypovolemia, which can be caused by diuretics, ARNI & SGLT2i, as this increases the risk of hyperkalemia

MODERATE HYPERKALEMIA
K^+ 5.6 to 5.9mmol/L

- reinforce a low potassium diet BC's Food Sources of K^+ patient handout
- if K^+ ↑ over time, ↓ the dose of ACEI, ARB, ARNI, or MRA by 50%
- if sudden ↑ in K^+, stop most recently added HF RAAS medication
- recheck K^+ and renal function within 72 hours
- if K^+ remains >5.5mmol/L, stop at least one medication; recheck K^+ within 72 hours. If K^+ still remains >5.5mmol/L, consider calcium or sodium polystyrene, or sodium zirconium cyclosilicate **LOKELMA**
- consider rechallenging by starting one RAAS inhibitor at a time, when K^+ <5mmol/L and contributing factors addressed
- document if unable to be on a HF RAAS inhibitor due to K^+

SEVERE HYPERKALEMIA
K^+ > 5.9mmol/L

- hold all RAAS inhibitors (i.e. ACEI, ARB, ARNI, MRA)
- order 12-lead ECG, & treat hyperkalemia as per local protocol
- when K^+ <5mmol/L and contributing factors addressed, consider rechallenge by starting one RAAS inhibitor at a time
- document if unable to be on a HF RAAS inhibitor due to K^+

WORSENING RENAL FUNCTION

A slight decline in renal function is expected after:
- initiating or titrating an ACEI, ARB or ARNI (↑ SCr <30% or ↓ eGFR <30%)
- starting a SGLT2i (↓ eGFR of 15-20%)

Monitor closely if starting a SGLT2i at the same time as starting / ↑ an ACEI, ARB, or ARNI. Renal function tends to improve over time esp ARNI & SGLT2i in HF.

TIPS WHEN INITIATING ACEI, ARB, ARNI or SGLT2i TO REDUCE THE RISK OF WORSENING RENAL FUNCTION

- check SCr & urea at baseline, and 1 to 2 weeks after starting or titrating these medications
- reassess diuretics, & reduce diuretic dose by 30-50% if euvolemic
- ensure the patient is not using NSAIDs / COX-2 inhibitors as these ↑ K^+, fluid retention, ↑ SCr, etc
- avoid combining an ACEI & ARB → ↑ risk of adverse events, including worsening renal function

SCr ↑ >30% or eGFR ↓ >30% from baseline

- reassess diuretics; ↓ dose / stop to maintain an euvolemic state
- if above step not sufficient or applicable: reduce dose of ACEI, ARB or ARNI by half & recheck SCr and BUN in 1-2 weeks, rechallenge if clinically appropriate; if dramatic ↑ SCr query renal artery stenosis
- monitor K^+ as renal dysfunction increases the risk of hyperkalemia
- document if unable to be on an ACEI, ARB, ARNI or SGLT2i due to renal function

HYPONATREMIA

- taper diuretic to an euvolemic state, if possible
- thiazide diuretics (e.g. metolazone) ↓ Na^+ more than loop diuretics (e.g. furosemide); ↓ or stop thiazide diuretics &, if needed, ↑ loop diuretics
- review all medications for other drug-induced causes / contributors to hyponatremia (e.g. SSRIs) & fluid intake
- avoid ↑ dietary Na^+ or using NaCl tablets, as Na^+ → fluid retention → HF symptoms / exacerbation

GOUT

- diuretics can increase uric acid, and therefore increase the risk of gout
- hyperuricemia without gout → monitor
- symptomatic gout treatment: colchicine preferred, prednisone; AVOID NSAIDs
- gout prophylaxis if ≥2 attacks / year: allopurinol is the preferred agent

DRY COUGH

- incidence of cough: ACEI 10-20%, ARB <1%
- cough is also a sign of HF congestion, especially with COPD
- document presence or absence of cough prior to initiating an ACEI, ARB, or ARNI
- if cough develops, is bothersome (e.g. unable to sleep), & not associated with other signs or symptoms of congestion: hold ACEI and then rechallenge to see if cough improves; if recurs, switch to ARB

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