

Clinical Decision Support (CDS) Content and Health Level 7 (HL7)- Compliant Knowledge Artifacts (KNARTs)

Cardiology: Admission Orders - Heart Failure Clinical Content White Paper

Department of Veterans Affairs (VA)



**Knowledge Based Systems (KBS)
Office of Informatics and Information Governance (OIIG)
Clinical Decision Support (CDS)**

Clinical Decision Support (CDS) Content and Health Level 7 (HL7)-Compliant Knowledge Artifacts (KNARTs): Cardiology: Admission Orders - Heart Failure Clinical Content White Paper

by Department of Veterans Affairs (VA)

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Table 1. Relevant KNART Information: Cardiology: Admission Orders - Heart Failure

KNART Name	Associated CLIN
Admission Orders: Heart Failure - Order Set	CLIN0008DA

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Introduction

The Department of Veterans Affairs (VA) is committed to improving the ability of clinicians to provide care for patients while increasing quality, safety, and efficiency. Recognizing the importance of standardizing clinical knowledge in support of this goal, VA is implementing the Health Level 7 (*HL7*) Knowledge Artifact Specification for a wide range of VA clinical use cases. Knowledge Artifacts, referred to as KNARTs, enable the structuring and encoding of clinical knowledge so the knowledge can be integrated with electronic health records to enable clinical decision support.

The purpose of this Clinical Content White Paper (*CCWP*) is to capture the clinical context and intent of *KNART* use cases in sufficient detail to provide the *KNART* authoring team with the clinical source material to construct the corresponding knowledge artifacts using the *HL7* Knowledge Artifact Specification. This paper has been developed using material from a variety of sources: VA artifacts, clinical practice guidelines, evidence in the body of medical literature, and clinical expertise. After reviewing these sources, the material has been synthesized and harmonized under the guidance of VA subject matter experts (*SMEs*) to reflect clinical intent for this use case.

Unless otherwise noted, items within this white paper (e.g., documentation template fields, orderable items, etc.) are chosen to reflect the clinical intent at the time of creation. To provide an exhaustive list of all possible items and their variations is beyond the scope of this work.

Conventions Used

Conventions used within the knowledge artifact descriptions include:

<obtain>: Indicates a prompt to obtain the information listed

- If possible, the requested information should be obtained from the underlying system(s). Otherwise, prompting the user for information may be required
- The technical and clinical notes associated with a section should be consulted for specific constraints on the information (e.g., time-frame, patient interview, etc.)
- Default Values: Unless otherwise noted, *<obtain>* indicates to obtain the most recent observation. It is recognized that this default time-frame value may be altered by future implementations

[...]: Square brackets enclose explanatory text that indicates some action on the part of the user, or general guidance to the clinical or technical teams. Examples include, but are not limited to:

[Begin ...] , *[End ...]*: Indicates the start and end of specific areas to clearly delineate them for technical purposes.

[Activate ...]: Initiates another knowledge artifact or knowledge artifact section.

[Section Prompt: ...]: If this section is applicable, then the following prompt should be displayed to the user.

[Section Selection Behavior: ...]: Indicates technical constraints or considerations for the selection of items within the section.

[Attach: ...]: Indicates that the specified item should be attached to the documentation template if available.

[Link: ...]: Indicates that rather than attaching an item, a link should be included in the documentation template.

[Clinical Comment: ...]: Indicates clinical rationale or guidance.

[Technical Note: ...]: Indicates technical considerations or notes.

[If ...]: Indicates the beginning of a conditional section.

[Else, ...]: Indicates the beginning of the alternative branch of a conditional section.

[End if ...]: Indicates the end of a conditional section.

☐ *[Check boxes]*: Indicates items that should be selected based upon the section selection behavior.

Chapter 1. Cardiology: Admission Orders - Heart Failure

1.1. Clinical Context

[Begin Clinical Context.]

The Cardiology Admission Orders: Heart Failure *KNART* is intended for clinical providers caring for adult patients in a Clinic or an Emergency Department (*ED*) setting being admitted with a diagnosis of heart failure, initial or recurrent episode.

The context domains are summarized in the table below:

Table 1.1. Clinical Context Domains

Target User	Provider in an outpatient clinic, hospital and <i>ED</i> settings
Patient	Adult patient being admitted with a diagnosis suggestive of initial or recurrent heart failure
Priority	Routine
Specialty	Outpatient primary care or cardiology, Emergency Medicine, Hospitalist Medicine, or Intensive Care Unit (<i>ICU</i>) Medicine
Location	Outpatient or <i>ED</i>

[End Clinical Context.]

1.2. Knowledge Artifacts

[Begin Knowledge Artifacts.]

Heart failure is a highly prevalent condition that is associated with significant morbidity and mortality and with tens of billions of dollars of annual expense in the United States [(Yancy 2013)]. While clinical advances and authoritative guidelines have been developed, substantial practice variation still exists among caregivers, denying patients access to potentially life-extending treatment. Operationalizing evidence-based practice guidelines, therefore, has the potential to improve outcomes among a large number of patients while delivering more cost-effective care.

The clinical decision support (*CDS*) knowledge artifact for the heart failure admission order set use case is:

- Cardiology: Admission Orders - Heart Failure Order Set *KNART*
 - Orderable items
 - Includes logic for appropriate display of the order set

[End Knowledge Artifacts.]

Chapter 2. Cardiology: Admission Orders - Heart Failure Order Set

[Begin Cardiology: Admission Orders - Heart Failure Order Set.]

2.1. Knowledge Narrative

[Begin Knowledge Narrative.]

[See Clinical Context in Chapter 1.]

[Section Prompt: This order set should be used during the admission of patients presenting with a diagnosis of heart failure.]

[End Knowledge Narrative.]

2.2. Admit To

[Begin Admit To.]

[Section Prompt: Admit To?]

[Section Selection Behavior: Required. Select only one.]

- ☐ Medical ward
- ☐ Telemetry
- ☐ Stepdown unit
- ☐ ICU
- ☐ Other <obtain> Location

[End Admit To.]

2.3. Diagnosis

[Begin Diagnosis.]

[Section Prompt: Diagnosis?]

[Section Selection Behavior: Required. Select only one.]

- ☐ Congestive heart failure (*CHF*)
- ☐ Other <obtain> Diagnosis

[End Diagnosis.]

2.4. Allergies

[Begin Allergies.]

[Section Prompt: Medication allergies?]

[Section Selection Behavior: Required. Select only one.]

- ☐ No known drug allergies
- ☐ Other <obtain> List of allergies

[End Allergies.]

2.5. Code Status

[Begin Code Status.]

[Section Prompt: Code status?]

[Section Selection Behavior: Required. Select only one.]

- ☐ Full code
- ☐ Do Not Resuscitate (*DNR*)/Do Not Intubate (*DNI*)

[Technical Note: Link to Attending *DNR/DNI* order set]

- ☐ Other <obtain> Code status

[End Code Status.]

2.6. Vital Signs and Monitoring

[Begin Vital Signs and Monitoring.]

[Section Prompt: Vital Signs and Monitoring]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Continuous telemetry
- ☐ Vital signs
 - ☐ Routine
 - ☐ Every <obtain> Hours
 - ☐ With pulse oximetry
- ☐ Weight daily (pounds)
- ☐ Height (inches)

[Technical Note: If admitted to medical ward, then display the medical ward section.]

[Begin Medical Ward Section.]

[Section Prompt: Medical Ward Orders]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Oxygen saturation every 4 hours
- ☐ Intake/output recording
 - ☐ Routine per local policy
 - ☐ Strict per local policy
 - ☐ Every <obtain> Hours

[End Medical Ward Section.]

[Technical Note: If admitted to *ICU*, then display the *ICU* section.]

[Begin *ICU* Section.]

[Section Prompt: *ICU* Orders]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Oxygen saturation continuous
- ☐ Intake and output
 - ☐ Routine per local policy
 - ☐ Strict per local policy
 - ☐ Every 1 hour
- ☐ Invasive hemodynamic monitoring
 - ☐ Arterial line
 - ☐ Pulmonary artery catheter

[End *ICU* Section.]

[End Vital Signs and Monitoring.]

2.7. Activity

[Begin Activity.]

[Section Prompt: Activity]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Bed rest
- ☐ Bed rest with bedside commode
- ☐ Bed rest with bathroom privileges
- ☐ Ambulate with assistance <obtain> Frequency
- ☐ Occupational/physical therapy assessment/assistance
- ☐ Out of bed to chair <obtain> Frequency
- ☐ Other specify <obtain> Other activity
- ☐ May be off telemetry for <obtain> Reason

[End Activity.]

2.8. Nursing

[Begin Nursing.]

[Section Prompt: Urinary Catheter]

[Section Selection Behavior: Optional. Select all that apply.]

☐ Insert Foley (indwelling urinary) catheter (note: routine urinary catheterization not recommended unless benefits outweigh risks)

☐ Discontinue urinary catheter after 48hrs (reorder for continued use)

☐ Condom catheter

[Section Prompt: Peripheral Intravenous (IV) Line]

[Section Selection Behavior: Optional. Select all that apply.]

☐ Insert peripheral *IV* line

☐ Saline lock

☐ Heparin lock

☐ Routine *IV* Care per local policy

[Section Prompt: Fluid Restriction]

[Section Selection Behavior: Optional. Select all that apply.]

☐ Restrict fluids

<obtain> Maximum liters per 24 hours

[Section Prompt: Diet]

[Section Selection Behavior: Required. Select at least one.]

☐ Regular

☐ Nil per os (*NPO*)

☐ *NPO* except meds

☐ Cardiac diet

☐ Low sodium

☐ Low cholesterol

☐ Low fat

☐ 2gm Na

☐ No added salt

☐ Diabetic diet <obtain> Calories

☐ Other [tube feeding, Total Parenteral Nutrition (*TPN*), etc.] <obtain> Other diet

[End Nursing.]

2.9. Venous Thromboembolism (*VTE*) Prophylaxis

[Begin Venous Thromboembolism (*VTE*) Prophylaxis.]

[Section Selection Behavior: Optional.]

[Technical Note: The order below can be linked to the *VTE* prophylaxis *KNART*, if available.]

☐ Conduct *VTE* prophylaxis risk screening and order appropriate protocol

[Section Prompt: Notify Clinician for:]

[Section Selection Behavior: Optional. Select all that apply.]

[Technical Note: Default values are specified in square brackets below. The user should be able to override the default values.]

☐ Temperature greater than [38.5 degrees Celsius]

☐ Systolic blood pressure (*BP*) greater than [170 mmHg]

☐ Systolic *BP* lower than [90 mmHg]

☐ Diastolic *BP* greater than [110 mmHg]

☐ Diastolic *BP* less than [40 mmHg]

☐ Heart rate greater than [130 bpm]

☐ Heart rate less than [50 bpm]

☐ Respiratory rate greater than [24 breaths per minute]

☐ Respiratory rate less than [10 breaths per minute]

☐ Urine output less than [0.5 mL/kg/hr]

[End Venous Thromboembolism (*VTE*) Prophylaxis.]

2.10. Immunizations

[Begin Immunizations.]

[Section Selection Behavior: Optional. Select all that apply.]

☐ Pneumovax

☐ Influenza vaccine

[End Immunizations.]

2.11. Laboratory Tests

[Begin Laboratory Tests.]

[Section Selection Behavior: Optional. Select all that apply.]

☐ Basic metabolic profile

☐ Now

☐ Daily

☐ Complete metabolic panel

☐ Now

☐ In am

☐ Brain natriuretic peptide

☐ Now

☐ In am

☐ Complete blood count

☐ Now

☐ In am

☐ Fasting lipid profile

☐ In am

☐ Partial Thromboplastin Time (*PTT*)

☐ Now

☐ In am

☐ Prothrombin Time (*PT*)/International Normalized Ratio (*INR*)

☐ Now

☐ Daily

☐ Liver function testing daily

☐ Thyroid Stimulating Hormone (*TSH*)

☐ Now

☐ In am

☐ Troponin I

☐ Now

☐ q 8 hours x 3

☐ Magnesium

☐ Now

☐ In am

☐ Digoxin level

☐ Now

☐ In am urinalysis

☐ Arterial Blood Gas

☐ Now

[Section Prompt: Point of Care Tests]

[Section Selection Behavior: Optional. Select all that apply.]

☐ Blood glucose every 4 hours

☐ Blood glucose now

[End Laboratory Tests.]

2.12. Diagnostic Testing

[Begin Diagnostic Testing.]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ 12-lead electrocardiogram (Dx: heart failure)
 - ☐ Now
 - ☐ In am
- ☐ X-ray chest (Dx: heart failure)
 - ☐ Posterioranterior (*PA*)/Lateral
 - ☐ Now
 - ☐ In am
 - ☐ Portable Anteroposterior (*AP*)
 - ☐ Now
 - ☐ In am
- ☐ Echocardiogram, transthoracic (*TTE*) (Dx: Heart failure)
 - ☐ Now
 - ☐ In am
- ☐ Echocardiogram, transesophageal (*TEE*), (Dx: Heart failure)
 - ☐ Now
 - ☐ In am
- ☐ Thallium Myocardial Perfusion Imaging (*MPI*) viability testing
- ☐ MPI single-photon emission computed tomography (*SPECT*) for the etiology of cardiomyopathy
- ☐ Cardiac magnetic resonance imaging (*MRI*) (with Gd delayed enhancement) for viability/etiology of cardiomyopathy
- ☐ Multigated Acquisition Scan (*MUGA*) to define the Left Ventricular Ejection Fraction (*LVEF*) and/or Right Ventricular Ejection Fraction (*RVEF*)

[End Diagnostic Testing.]

2.13. Oxygen

[Begin Oxygen.]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Oxygen therapy per protocol
- ☐ Nasal cannula 2 L/min or <obtain> L/min
 - ☐ Titrate to oxygen saturation > 90%

☐ Face mask 40% fraction of inspired oxygen (FiO_2) titrate to oxygen saturation > 90%

☐ Nonrebreather face mask 15 L titrate to oxygen saturation > 90%

[End Oxygen.]

2.14. Consults and Referrals

[Begin Consults and Referrals.]

[Section Selection Behavior: Optional. Select all that apply.]

☐ Consult cardiology

☐ Advanced heart failure service for heart failure management

☐ Consult electrophysiology service for consideration of device therapy [(Implantable Cardioverter-Defibrillator (*ICD*), Cardiac Resynchronization Therapy (*CRT*)]

[End Consults and Referrals.]

2.15. Medications

[Begin Medications.]

[Section Selection Behavior: Optional. Select all that apply.]

☐ IV Fluid

☐ Normal saline (*NS*)

☐ Lactated Ringers (*LR*)

☐ Dextrose 5%, ½ Normal Saline

☐ Other <obtain> IV Fluids

☐ Aspirin enteric coated, select one of the following:

☐ 81 mg daily

☐ 325 mg daily

[Section Prompt: Diuretics]

[Section Selection Behavior: Optional. Select all that apply.]

☐ Furosemide specify: <obtain 20-120 mg> solution IV bolus

☐ Now

☐ Every <obtain> hours

☐ Bumetanide specify: <obtain 0.5-2 mg> solution IV bolus

☐ Now

☐ Every <obtain> hours

☐ Metolazone <obtain 2.5-5 mg> oral daily, 30 minutes prior to loop diuretic dose

[Section Prompt: Potassium Replacement]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Potassium replacement per protocol
- ☐ Potassium chloride <obtain 10-20 meq> (max 60 meq) oral
 - ☐ Once
 - ☐ Daily
 - ☐ Bid

[Section Prompt: Angiotensin-Converting Enzyme (ACE-I) Inhibitors [if not on Angiotensin Receptor Blockers (ARBs)]]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Captopril [initial 6.25-12.5, max 50] mg oral, three times daily (tid)
- ☐ Lisinopril [initial 2.5-5, max 40] mg tablet oral daily hold for symptomatic systolic *BP* < 90
- ☐ Enalapril [initial 2.5, max-20] mg tablet oral daily hold for symptomatic systolic *BP* < 90

[Section Prompt: Angiotensin II Receptor Blockers (ARBs) [if not on ACE-I]]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Losartan [initial 25-50, max 150] mg tablet oral daily hold for symptomatic systolic *BP* < 90
- ☐ Valsartan [initial 20- 40, max 160] mg tablet oral two times daily hold for symptomatic systolic *BP* < 90

[Section Prompt: Angiotensin Receptor-Nepirylsin Inhibitors (ARNIs)]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Valsartan 49 mg/sacubitril 51 mg 1 tablet oral two times daily hold for symptomatic systolic *BP* < 90

[Section Prompt: Beta-Blockers]

- ☐ Metoprolol succinate [initial 12.5-25, max 200] mg tablet oral daily hold for symptomatic systolic *BP* < 90
- ☐ Carvedilol [initial 3.125, max 25] mg tablet oral two times daily hold for symptomatic systolic *BP* < 90

[Section Prompt: Aldosterone Antagonists]

- ☐ Spironolactone [initial 12.5, max] 25 mg tablet oral daily
- ☐ Eplerenone [initial 25, max 50] mg tablet oral daily

[Section Prompt: Hydralazine/Nitrates]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Hydralazine 37.5 mg/ Isosorbide dinitrate 20 mg 1 tablet oral three times daily (tid)

[Section Prompt: Cardiac Glycosides]

[Section Selection Behavior: Optional. Select all that apply.]

- ☐ Digoxin 0.125 micrograms tablet oral daily

[End Medications.]

[End Cardiology: Admission Orders - Heart Failure Order Set.]

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Appendix A. Existing Sample VA Artifacts

All of the figures illustrated below are referenced from the Portland VAMC.

Figure A.1. Inpatient Diet Menu

Inpatient Diet Menu (Rev 7.2013)

Instructions and Guidelines

- **DO NOT** use 'Additional Diet Orders' option to order changes, tubefeeds, fluid restrictions, or early/late I
- Previous diets can be reviewed via Reports Tab/Clinical Reports/Dietetics/Diet
- Insulin orders **MUST** be rewritten when transitioning between diet and NPO status

Restricted Diets

- NPO
- NPO after Midnight
- NPO at a specific time
- Clear Liquids
- **Replace do not Cancel NPO orders**

Standard Healthy Diets

- Regular
- Cardiac (Lo fat/3 to 4g Na/Lo Chol)
- Mechanical Soft
- Vegetarian
- Large Servings
- Finger Foods
- Finger Foods/Mechanical

Diabetes-related Diets

- Targeted Nutrient Levels
- Constant Carbs
- 2400 Calorie
- 1800-2000 Calorie
- 1500 Calorie

Cancer-related Diets

- Bland
- Hi Protein

Special Diets

- Dysphagia Diets Submenu
- Tube Feeding Orders Submenu
- Nourishment for Tube Feeding
- TPN Orders

Fluid Management Diets (CHF, cirrhosis)

- Low Sodium (2g Na+)/2000ml Fluid Restr
- Low Sodium (2g Na+)/1500ml Fluid Restr
- 2G Na+/No Free Water
- Mild Sodium (3 to 4 Na+)/2000ml Fluid Restr
- Mild Sodium (3 to 4g Na+)/1500ml Fluid Restr
- Mild Sodium (3 to 4g Na+)/No Free Water

Renal and Electrolytes Management Diets

- Renal Diet / 2000ml
- Renal Diet / 1500ml
- Renal Diet / No Free Water
- Low Potassium (2g K+)
- Low Phosphorus

Other Diets

- High Fiber
- Low Fiber
- Lactose Controlled
- Gluten Controlled
- Low Iodine
- PET Scan Prep Diet
- No Tray
- Isolation/Precautions
- Nourishment (snacks)/No Tray

Location Specific Diet Menus

- CLC/Rehab Diet Menu
- ICU/CCU Diet Menu

Early and Late Tray Requests

Early / Late Tray Order

Cutoff Schedule:

- Early Breakfast - 5:45 am
- Late Breakfast - 9:00 am
- Early Lunch - 10:15 am
- Late Lunch 1st - 1:00 pm
- Late Lunch 2nd - 2:00 pm
- Early Dinner - 3:30 pm
- Late Dinner - 6:30 pm

NOTE: When ordering Early/Late meals ordering time is NOT delivery time

Consults

- Dietetics (Portland)
- Dietetics (Vancouver)
- Speech Path (Portland)
- Speech Path (Vancouver)

Links

- Link to PVAMC Diet Manual

Figure A.2. Congestive Heart Failure (CHF) Medications

CHF Meds (Rev. 11.03)

ACE Inhibitors

- Lisinopril 5mg Daily
- Lisinopril 10mg Daily
- Lisinopril 20mg Daily
- Lisinopril 30mg Daily
- Lisinopril 40mg Daily
- Captopril 6.25mg Q8H
- Captopril 12.5mg Q8H
- Fosinopril 10mg Daily <R>
- Fosinopril 20mg Daily <R>
- Fosinopril 40mg Daily <R>
- ARB Menu

Diuretics

Oral

- Furosemide PO X 1
- Furosemide PO Daily
- Furosemide PO BID

IV

- Furosemide IV X 1
- Furosemide IV Daily
- Furosemide IV BID

Diuretics (cont)

- Spironolactone Menu
- Metolazone 2.5mg Daily
- Metolazone 5mg Daily
- Metolazone 10mg Daily

Beta Blockers

WARNING: Avoid abrupt withdrawal

Preferred Agent (CHF)

- Carvedilol 3.125mg BID
- Carvedilol 6.25mg BID
- Carvedilol 12.5mg BID
- Carvedilol 25mg BID
- Metoprolol tartrate 25mg BID
- Metoprolol tartrate 50mg BID
- Metoprolol tartrate Other Doses
- Metoprolol tartrate 5mg IV

Metoprolol XL - FOR CHF ONLY

- Metoprolol succinate XL 12.5mg Daily <R>
- Metoprolol succinate XL 25mg Daily <R>
- Metoprolol succinate XL 50mg Daily <R>
- Metoprolol succinate XL 100mg Daily <R>
- Metoprolol succinate XL Other Doses <R>

Other

- Digoxin
- Hydralazine 10mg QID
- Hydralazine 25mg QID
- Isosorbide mononitrate SA
- Isosorbide dinitrate TID
- KCl 10mEq Daily
- KCl 10mEq BID
- KCl 20mEq Daily
- KCl 20mEq BID
- Potassium 20mEq IV
- Potassium 30mEq IV
- Potassium 40mEq IV

Medications (ALL)

Information/Guidelines

LINKS

- Cardiac meds-lipids
- Cardiac meds-HTN
- Cardiac meds-other
- Procedures

Consults

- General Cardiology
- Cardiology Nuclear

Figure A.3. Angiotensin Receptor Blockers (ARBs) Menu

ARB Menu (Revised 6/20/2005) Done

ARBs should be avoided in pregnancy (cat. D for 2nd & 3rd trimester)

INDICATION:
Heart Failure: <<Valsartan - Target Dose: 160mg BID>>
Pts w/ systolic HF and intolerant to an ACEI.
1. Cough.
2. Other non life-threatening reason.

HTN: <<Losartan>>
1. Cough.
2. Other non life-threatening reason.
+No monotherapy. Treat pts in combination w/ at least one other anti-HTN agent, where BP is at or near goal.

DM Nephropathy and/or Kidney Disease: <<Losartan>>
1. Type II DM with nephropathy and HTN, intolerant to ACEI.
2. Kidney dx w/ proteinuria/microalbuminuria, intolerant to ACEI.
3. Combo tx w/ optimal dose ACEI, w/ DM kidney dx w/ persistent proteinuria (>1 gm/d) or microalbuminuria.
a. D/C ARB if pt does not respond in 2-3 months.

NOTE:
+ It is unknown if an angiotensin II receptor antagonist can be safely used as an alternative in patients who develop renal dysfunction or hyperkalemia with an ACEI, or whose treatment with an ACEI is limited due to renal dysfunction, as these adverse events have also occurred with the use of an angiotensin II receptor antagonist.
+ Therapy with an ARB is not recommended in patients who experience angioedema with an ACEI. It is recommended that an alternative drug be used in these patients, or that Nephrology Service be consulted.

<<ARB Conversion Chart>>

Figure A.4. Angiotensin Receptor Blockers (ARBs) Conversion

ARB CONVERSION Done

ARBs should be avoided in pregnancy (category D for 2nd & 3rd trimester)

Approximate equivalent doses of ARB's
+++Doses are TOTAL DAILY DOSE ranges.

Drug	Dose Range		Max. Dose	
<<Candesartan>> (eFER)	8MG	16MG	32MG	32MG
<<Losartan>> <R>	25MG	50MG	100MG	100MG
<<Valsartan>> <R>	80MG	160MG	320MG	320MG
<<Ibuprofen>> (eFER)	150MG		300MG	300MG
Eprosartan	400MG	600MG	800MG	800MG
Omesartan	20MG	30MG	40MG	40MG
Telmisartan	20MG	40MG	80MG	80MG

*Note: These are approximate equivalents; patients need to be monitored when switching from one drug to another.

Figure A.5. Digoxin Menu

Digoxin Menu (12/2014)

Done

Guidelines:
 Reduced dosing is recommended for any of the following:
 Renal Insuff. (CrCL < 30)
 Pts over 70 yrs old
 Weight less than 60kg

Digoxin for HEART FAILURE:
 • No loading doses
 • Therapeutic concentration 0.5 to 0.9ng/mL is suggested
 • Digoxin is commonly initiated & maintained at low dose of 0.125mg to 0.25mg daily

Normal Dosing:
 << 0.125mg Daily >>
 << 0.25mg Daily >>

Reduced Dosing:
 << 0.125mg Every Other Day >>
 << 0.125mg Daily >>

Digoxin for ATRIAL FIBRILLATION:
 • Use lowest possible dose necessary to control rate.
 • IV formulation is preferred if rapid onset of action is desired or if the oral route is not a feasible option

Normal Dosing:
 << IV LOAD >> (0.25mg IV now then 0.25mg q6h x2)
 << ORAL LOAD >> (0.25mg po now then 0.25mg q6h x2)
 << Maintenance Dose: 0.125mg Daily >>
 << Maintenance Dose: 0.25mg Daily >>

Reduced dosing:
 << IV LOAD >> (Reduced dose: 0.25mg IV now then 0.125mg q6h x2)
 << ORAL LOAD >> (Reduced dose: 0.25mg po now then 0.125mg q6h x2)
 << Maintenance Dose: 0.125mg Every Other Day >>
 << Maintenance Dose: 0.125mg Daily >>

When to measure digoxin levels:
 • Suspected toxicity (e.g. atrial fibrillation with a regular ventricular rate)
 • Inefficacy or nonadherence
 • Diseases/physiological changes that can affect level (renal impairment)
 • Significant drug interactions (e.g. amiodarone)

Notes on digoxin monitoring:
 • It takes at least 5 days to reach steady state after initiating therapy or change in dose. Can take up to 3 weeks for those with renal impairment.
 • When testing check level 6hrs after dose is given to allow for tissue distribution or as a trough just prior to next dose.
 • Monitor electrolytes & renal function

Notes on digoxin toxicity:
 • Dig toxicity is a function of increasing dig blood level but is also potentiated by hypokalemia & hypoxemia. Consider benefits of digoxin vs risk of toxicity in pts w/ this combo (e.g. pts w/ severe COPD & also on diuretics are potentially higher risk of digoxin toxic arrhythmias because they are often hypoxic and often on diuretics thus potentially hypokalemic)

Digoxin Kinetics:
 Onset of action:
 IV: 5 to 30 minutes
 PO: 30 minutes to 2 hours

Peak response:
 IV: 1 to 4 hours
 PO: 2 to 6 hours

Labs
 Digoxin
 Magnesium
 Potassium
 Calcium
 Creatinine

Figure A.6. Spironolactone Information and Orders

Spironolactone: Information and Orders

Done

Information on this menu applies for CHF indication.

Information (HYPERKALEMIA RISK):

- Contraindications:
 Creatinine > 1.9
 K+ > 5.0 (and approx normal Cr)
- Consider holding oral K+
- Monitor K+ and Cr
 << Chem 7 >>

Dosing Information:

- Start at 25MG << Spironolactone 25MG QAM >>
- Max dose 50MG

<< Spironolactone Use for Ascites >>

Figure A.7. Inpatient Antilipid Medications

ANTILIPID MEDICATIONS / INPATIENT			
HMG CoA reductase inhibitors First Line Therapy Lovastatin 10mg Lovastatin 20mg Lovastatin 40mg If >40mg go to Simva Simvastatin 40mg Simvastatin 80mg Other Antilipidemics Colestipol Gemfibrozil 600mg	Conversions: HMG-CoA to Lovastatin dose. Atorvastatin 5mg Atorvastatin 10mg Atorvastatin 20mg (Dose approx 1/4 Lova) Fluvastatin 20mg Fluvastatin 40mg Fluvastatin 80mg (Dose approx 2X Lova)	Conversions (cont) Pravastatin 10mg Pravastatin 20mg Pravastatin 40mg (Dose approx equal Lova) Note: Conversions are never exact! Please monitor patient closely.	All Medications Information/Guidelines Consults

Figure A.8. JNC 7 Heart Failure Recommendations

JNC7 Heart Failure Recommendations
Clinical Trial and Guideline Basis for Compelling Indications for Individual Drug Classes*: HEART FAILURE: + Loop Diuretic/B-Blocker/ACE Inhibitor/ARB/Aldosterone Antagonist NOTE: "The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure" JAMA 5.20.03

Figure A.9. Heart Failure Documentation

HEART FAILURE DOCUMENTATION
 prepared by J. Nativi-Nicolau and J. Stehlik. Last update Sept 2014

HEART FAILURE ASSESSMENT

- Heart Failure Syndrome
 - Acute vs Chronic heart failure
 - Systolic vs Diastolic (reduced vs preserved EF)
 - New York Heart Association functional class
 - I: no symptoms
 - II: Symptoms with moderate exertion
 - III: Symptoms with minimal exertion
 - IV: Symptoms at rest
 - ACC/AHA Stage:
 - A: Risk factors
 - B: Structural heart disease without symptoms
 - C: Symptoms of heart failure
 - D: Advanced/refractory heart failure
- Etiology:
 - Ischemic, non-ischemic, valvular, congenital, etc.
 - Describe recent and past LV ejection fractions
- Hemodynamic profile: Congestion: dry vs wet
 Perfusion: warm vs cold

A: Warm and Dry	B: Warm and wet
L: Cold and Dry	C: Cold and Wet
- Treatment:
 - Symptoms - Diuretics ± potassium supplementation
 - HF Meds - ACE-I/ARB, beta-blockers, spironolactone
 - Check for adverse reactions/target doses
 - Devices - Defibrillator or Cardiac Resynchronization
 - Education - Weight, diet, symptoms, activity

2

Hemodynamic profile

CONGESTION (WET)	COLD (LOW CARDIAC OUTPUT)
Symptoms Dyspnea NYHA I, II, III, IV Orthopnea Paroxysmal nocturnal dyspnea	Symptoms Fatigue Exertion intolerance Nausea, abdominal pain
Signs Elevated JVP Rales S3 Edema Ascites	Signs Somnolence Cool extremities
Studies Elevated BNP Xray Pulmonary edema	Studies Renal failure Elevated lactate
Right heart cath and Echo Elevated filling pressures	Right heart cath and Echo Low cardiac output and index

Heart Failure Medications

Drug	Initial daily dose	Target dose
Captopril	6.25 mg 3 times	50 mg 3 times
Enalapril	2.5 mg twice	10 to 20 mg twice
Lisinopril	2.5 to 5 mg once	20 to 40 mg once
Candesartan	4 to 8 mg once	32 mg once
Losartan	25 to 50 mg once	50 to 100 mg once
Valsartan	20 to 40 mg twice	160 mg twice
Carvedilol	3.125 mg twice	25 mg twice
Meloprolol succinate XL	12.5 to 25 mg once	150 to 200 mg once
Spironolactone	12.5 to 25 mg once	25 mg once
Eplerenone	25 mg once	50 mg once

Appendix B. Basic Laboratory Panel Definition

- Blood urea nitrogen
- Calcium
- Chloride
- CO_2 (Carbon dioxide, bicarbonate)
- Creatinine
- Glucose
- Potassium
- Sodium

Acronyms

ACC	American College of Cardiology
ACCF	United States Preventive Task Force
ACE-I	Angiotensin-Converting Enzyme
AHA	American Heart Association
AP	Anteroposterior
ARBs	Angiotensin Receptor Blockers
ARNIs	Angiotensin Receptor-Neprilysin Inhibitors
BP	Blood Pressure
CCWP	Clinical Content White Paper
CDS	Clinical Decision Support
CHF	Congestive Heart Failure
CO2	Carbon Dioxide
CRT	Cardiac Resynchronization Therapy
DNI	Do Not Intubate
DNR	Do Not Resuscitate
ED	Emergency Department
HFSA	Heart Failure Society of America
HL7	Health Level 7
ICD	Implantable Cardioverter-Defibrillator
ICU	Intensive Care Unit
INR	International Normalized Ratio
IV	Intravenous
KBS	Knowledge Based Systems
KNART	Knowledge Artifact
LVEF	Left ventricular ejection fraction
MPI	Myocardial perfusion
MRI	Magnetic Resonance Imaging
MUGA	Multigated acquisition scan
NPO	Nothing by mouth
OIIG	Office of Informatics and Information Governance
PA	Posterioranterior

PT	Prothrombin Time
PTT	Partial Thromboplastin Time
RVEF	Right ventricular ejection fraction
SPECT	Single-photon emission computed tomography
TEE	Transesophageal
TO	Task Order
TSH	Thyroid Stimulating Hormones
TTE	Transthoracic
VA	Department of Veteran Affairs
VAMC	VA Medical Center
VTE	Venous Thromboembolism