CONCORD INTERNAL & PULMONARY MEDICINE

CONGESTIVE HEART FAILURE PROTOCOL

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Congestive Heart Failure Protocol

Patients present in 1 of 3 ways
1. Syndrome of decreased exercise tolerance.
2. Syndrome of fluid retention.
3. Incidentally discovered left ventricular dysfunction.

History
Physical Exam
CXR
EKG
LVEF measured by 2D Echo of the heart and/or Rest MUGA and/or Cardiac Cath (Use highest LVEF measured)
U/A
CBC
CMP
Stress Test to rule out CAD
TSH Reflex
Calculated GFR
Spot urine for A/C ratio

Treat lipid disorder
Encourage smoking cessation
Encourage regular exercise
Discourage alcohol intake, illicit drug use

LVEF ≤ 40%
(See Page 2)

LVEF > 40%
(See Page 23)
Congestive Heart Failure
Left Ventricular Systolic Dysfunction

LVEF ≤ 40

Ischemic cardiomyopathy?

Yes

NYHA Class I (See Page 3)

ACEI (See Page 8)
or ARB (See Page 13)
and Beta-Blocker (See Page 15)

NYHA Class II, III, & IV (See Page 3)

ACEI (See Page 8)
Or ARB (See Page 13)
and Aldosterone Antagonists
(See Page 21)
Beta-Blocker (See Page 15)
Digitalis (See Page 7)
Diuretic (See Page 4)
Dietary Salt Restriction
(Less than 3000mg sodium per day)

Repeat Echo in 3 months

NYHA Class II, III, & IV (See Page 3)

LVEF ≤ 40

LVEF > 40

No further evaluation

Is patient African American

Yes

No

Is patient African American

Yes

Begin Bidil or Hydralazine and Nitrate (See Page 18)

Patient on chronic optimal medical therapy

Consider Bidil or Hydralazine and Nitrate if clinically indicated (See Page 18)

No

Yes

LVEF < 35

NYHA Class II, III, & IV (See Page 3)

LVEF ≤ 40

LVEF > 40

Is patient African American

Yes

No

Is ischemic cardiomyopathy?

Yes

NYHA Class II, III, & IV (See Page 3)

LVEF < 35

Continue present treatment. Assess volume status on all visits.

No

Yes

Continue present treatment. Assess volume status on all visits.

Patient on chronic optimal medical therapy

Yes

No

LVEF ≤ 40

LVEF > 40

No further evaluation

Is patient African American

Yes

No

Is ischemic cardiomyopathy?

Yes

NYHA Class II, III, & IV (See Page 3)

LVEF < 35

Continue present treatment. Assess volume status on all visits.

No

Yes

Continue present treatment. Assess volume status on all visits.
# A Comparison of Two Methods of Assessing Cardiovascular Disability

<table>
<thead>
<tr>
<th>Class</th>
<th>New York Heart Association Functional Classification</th>
<th>Specific Activity Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Patients with cardiac disease but without resulting limitations of physical activity. Ordinary physical activity does not cause undue fatigue, dyspnea, or palpitation.</td>
<td>Patients can perform to completion any activity requiring $\leq 7$ metabolic equivalents: eg, can carry 24 lb up eight steps; carry objects that weigh 80 lb; do outdoor work (shovel snow, spade soil); do recreational activities (skiing, basketball, squash, handball, jog/walk 5 mph).</td>
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<tr>
<td>II</td>
<td>Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, dyspnea, or palpitation.</td>
<td>Patients can perform to completion any activity requiring $\leq 5$ metabolic equivalents: eg, have sexual intercourse without stopping, garden, rake, weed, roller skate, dance fox trot, walk at 4 mph on level ground, but cannot and do not perform to completion activities requiring $&gt; 7$ metabolic equivalents.</td>
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<tr>
<td>III</td>
<td>Patients with cardiac disease resulting in marked limitations of physical activity. They are comfortable at rest. Less than ordinary physical activity causes fatigue, dyspnea, or palpitation.</td>
<td>Patients can perform to completion any activity requiring $\leq 2$ metabolic equivalents: eg, shower without stopping, strip and make bed, clean windows, walk 2.5 mph, bowl, play golf, dress without stopping, but cannot and do not perform to completion any activities requiring $&gt; 5$ metabolic equivalents.</td>
</tr>
<tr>
<td>IV</td>
<td>Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency may be present even at rest. If any physical activity is undertaken, discomfort is increased.</td>
<td>Patients cannot or do not perform to completion activities requiring $&gt; 2$ metabolic equivalents. Cannot carry out activities listed above (Specific Activity Scale, Class III).</td>
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</table>

Diuretic Therapy

Class II - IV CHF

Assess volume status on all visits

Symptoms and/or signs of volume overload:
Symptoms: Dyspnea on exertion or rest; PVD; orthopnea; weight gain; abdominal bloating; decreased appetite; lower extremity swelling
Signs or symptoms of volume overload
Signs: Rales; JVP elevation; positive abdominal-jugular reflex; S3; sacral or extremity edema

Yes

Initiate or intensify sodium restriction. Consider fluid restriction < 2 liters/24 hr. especially if serum sodium < 130 mg/L. Discontinue NSAIDS or COX-2 inhibitors if patient on either or both

Yes

Is patient on maximum dose of Lasix? (80 mg po tid)

Yes

See Page 6

No

Increase dose and/or frequency of diuretic by 50-100%

See Page 5

No

Is patient on loop diuretic such as Lasix?

Yes

Begin Lasix 20-40 mg/day

No

Maintain sodium restriction. If on diuretic maintain at current dose.

Euvolemic

Symptoms: Dizziness/light headedness
Hyponolemic

Signs: Flat neck veins; symptomatic hypotension, elevated pulse rate, dry mucus membranes.

Reduce dose or discontinue diuretic temporarily. Consider loosening the degree of dietary sodium restriction

Re-evaluate patient in 2-3 days

Yes

No

See Page 6

See Page 5
Re-evaluate patient in 1 week or as clinically indicated

Symptoms and/or signs back to baseline
  - Identifiable causes for symptoms/signs CHF e.g. nonadherence
    - Resume original dose diuretic
  - No identifiable causes for symptoms/signs CHF
    - Continue increased dose diuretic

Symptoms and/or signs not back to baseline
  - Increase diuretic by 50-100% up to a maximum dose of Lasix of 80 mg po tid

  - Improvement of symptoms/signs but not back to baseline
    - See Page 6
  - Persistent or worsening symptoms/signs at maximum dose of Lasix
    - See Page 6
  - Symptoms/signs back to baseline
    - See Page 4
Begin metolazone 2.5 mg po daily
Give 30-60 mm before dose loop diuretic

Reassess patient in 3 days
BMP and magnesium in 3 days

Signs/symptoms
back to baseline

Stop metolazone
See Page 4

Signs/symptoms not
back to baseline

Increase po metolazone to
5 mg/day
Reassess patient in 3 days
BMP and magnesium in 3 days

Signs/symptoms
back to baseline

Consider admitting patient to the hospital
for IV loop diuretic

Discharge from hospital
See Page 4

See Page 4
Digoxin

Dosage

Patient elderly and/or
Patient small in stature and/or
Creatinine Clearance < 90

Yes

Begin 0.125 mg po daily

No

Begin 0.25 mg po daily

Measure digoxin level in 2-3 weeks
Measure level > 6 hours after last
dose of digoxin

Adjust digoxin to serum level of
0.8 mg/ml or less

Do not give more than 0.25 of
digoxin a day

Remeasure digoxin level if:
1. There is significant change in renal function.
2. Potentially interacting drug (Amiodarone, Quinidine or Verapamil) is added or discontinued.
3. Suspected digoxin toxicity based on signs/symptoms and/or EKG changes.
Angiotensin Converting Enzyme Inhibition (ACEI) Treatment in Left Ventricular Systolic Dysfunction (LVEF ≤ 40%)

Optimize and stabilize diuretic treatment before beginning ACEI therapy

Intractable cough with ACEI

Yes

Do not use ACEI. Consider treatment with angiotensin receptor blocker (ARB)

No

Angioedema with ACEI, bilateral renal artery stenosis and/or pregnancy

Yes

Measure BMP

No

K⁺ ≤ 5.5  
K⁺ > 5.5

Serum sodium < 130mEq/L  
Or  
Creatinine > 1.7

ACEI and ARB are contraindicated

K⁺ 5.0 – 5.5 mEq/L

Go to Page 9

K⁺ < 5.0 mEq/L

Go to Page 11

See Page 13
Initial Low Dose ACE Inhibitor (ACEI) Therapy

Measure supine and standing blood pressure (BP)

- Systolic BP < 90 supine and/or standing
  - Do not begin ACEI
  - Reevaluate patient in 2 weeks

- Systolic BP ≥ 90 supine and standing
  - Begin low dose ACEI
    (See Page 10 for initial dosing of ACEI)

  - Measure BMP in 1 week
    - Reevaluate patient in 2 weeks
      - Cough on ACEI
        - Yes
          - Hold diuretic
          - Reevaluate patient in 2-3 days
        - No
          - Double dose of ACEI
            Every 2 wks
            (See Page 10)
          - Target dose ACEI attained
            (See Page 10)

  - Reevaluate patient if creatinine rises ≥ 0.5 mg/dl from baseline and/or K⁺ > 5.0
    - Use ARB
      (See Page 13)
ACE Inhibitors
Low Initial Dose

Captopril (Capoten) 6.25mg tid for 2 weeks
Enalapril (Vasotec) 1.25mg BID for 2 weeks
Lisinopril (Zestril/Prinivil) 2.5mg daily for 2 weeks
Quinapril (Accupril) 2.5mg po BID for 2 weeks
Fosinopril (Monopril) 5mg daily for 2 weeks
Trandolapril (Mavik) 1mg daily for 2 weeks
Ramipril (Altace) 1.25mg for 2 weeks

Reevaluate Patient

Captopril (Capoten) 12.5mg tid for 2 weeks
Enalapril (Vasotec) 2.5mg BID for 2 weeks
Lisinopril (Zestril/Prinivil) 5mg daily for 2 weeks
Quinapril (Accupril) 5mg po BID for 2 weeks
Fosinopril (Monopril) 10mg daily for 2 weeks
Trandolapril (Mavik) 2mg daily for 2 weeks
Ramipril (Altace) 2.5mg for 2 weeks

Reevaluate Patient

Captopril (Capoten) 25mg tid for 2 weeks
Enalapril (Vasotec) 5mg BID for 2 weeks
Lisinopril (Zestril/Prinivil) 10mg daily for 2 weeks
Quinapril (Accupril) 10mg po BID for 2 weeks
Fosinopril (Monopril) 20mg daily for 2 weeks
Trandolapril (Mavik) 4mg daily for 2 weeks
Ramipril (Altace) 2.5mg BID for 2 weeks

Reevaluate Patient

Captopril (Capoten) 50mg tid for 2 weeks
Enalapril (Vasotec) 10mg BID for 2 weeks
Lisinopril (Zestril/Prinivil) 20mg daily for 2 weeks
Quinapril (Accupril) 20mg po BID for 2 weeks
Fosinopril (Monopril) 40 mg daily for 2 weeks
Trandolapril (Mavik) 8 mg daily for 2 weeks
Ramipril (Altace) 5mg BID for 2 weeks

Maximum Dose

Captopril (Capoten) 150mg tid
Enalapril (Vasotec) 20mg BID
Lisinopril (Zestril/Prinivil) 40mg daily
Quinapril (Accupril) 40mg po BID
Fosinopril (Monopril) 40mg daily
Trandolapril (Mavik) 8mg daily
Ramipril (Altace) 10mg BID

Reevaluate patient as clinically indicated
Initial Standard Dose ACE inhibitor (ACEI) Therapy

Measure supine and standing blood pressure (BP)

Systolic BP < 90 supine and/or standing
  Do not begin ACEI
  Re-evaluate patient in 2 weeks

Systolic BP ≥ 90 supine and/or standing
  Begin standard dose ACEI
  (See Page 12 for initial dosing of ACEI)

Measure BMP in 1 week
  Re-evaluate patient in 2 weeks

Re-evaluate patient if creatinine rises ≥ 0.5 mg/dl from baseline or K⁺ > 5.0

Cough on ACEI
  Use ARB
  (See Page 11)

Systolic BP < 90 supine and/or standing
  Yes
    Hold diuretic
    Re-evaluate patient in 2-3 days
  No
    Double dose of ACEI
    Every 2 weeks
    (See Page 12)

Target dose ACEI attained
  (See Page 12)
ACE Inhibitors
Standard Initial Dose

Captopril (Capoten)
Enalapril (Vasotec)
Lisinopril (Zestril/Prinivil)
Quinapril (Accupril)
Fosinopril (Monopril)
Trandolapril (Mavik)
Ramipril (Altace)

<table>
<thead>
<tr>
<th>Captopril (Capoten)</th>
<th>Enalapril (Vasotec)</th>
<th>Lisinopril (Zestril/Prinivil)</th>
<th>Quinapril (Accupril)</th>
<th>Fosinopril (Monopril)</th>
<th>Trandolapril (Mavik)</th>
<th>Ramipril (Altace)</th>
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<tr>
<td>12.5mg tid for 2 weeks</td>
<td>2.5mg BID for 2 weeks</td>
<td>5mg daily for 2 weeks</td>
<td>5mg po BID for 2 weeks</td>
<td>10mg daily for 2 weeks</td>
<td>2mg daily for 2 weeks</td>
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<tr>
<td>25mg tid for 2 weeks</td>
<td>5mg BID for 2 weeks</td>
<td>10mg daily for 2 weeks</td>
<td>10mg BID for 2 weeks</td>
<td>20mg daily for 2 weeks</td>
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<td>50mg tid for 2 weeks</td>
<td>10mg BID for 2 weeks</td>
<td>20mg daily for 2 weeks</td>
<td>20mg po BID for 2 weeks</td>
<td>40 mg daily for 2 weeks</td>
<td>8 mg daily for 2 weeks</td>
<td>5mg BID for 2 weeks</td>
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<td>Maximum Dose</td>
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<tr>
<td>150mg tid</td>
<td>20mg BID</td>
<td>40mg daily</td>
<td>40mg po BID</td>
<td>40mg daily</td>
<td>8mg daily</td>
<td>10mg BID</td>
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</table>
Angiotensin Receptor Blocker (ARB) Therapy

Measure supine and standing blood pressure (BP)

Systolic BP < 90 supine and/or standing

Do not begin ACEI
Re-evaluate patient in 2 weeks

Systolic BP ≥ 90 supine and/or standing

Begin initial dose ARB
(See Page 14)

Reevaluate patient if creatinine rises ≥ 0.5mg/dl from baseline or K > 5.0

Measure BMP in 1 week

Reevaluate patient in 2 weeks

Systolic BP ≤ 90 supine and/or standing

Yes
Hold diuretic
Re-evaluate patient in 2-3 days

No
Double dose of ARB
Target dose ARB attained
(See Page 14)
## Angiotensin Receptor Blockers (ARB)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
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<tbody>
<tr>
<td>Candesartan</td>
<td>4mg day for 2 weeks</td>
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<tr>
<td>Irbesartan</td>
<td>150mg daily for 2 weeks</td>
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<tr>
<td>Losartan</td>
<td>25mg BID daily for 2 weeks</td>
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<tr>
<td>Valsartan</td>
<td>40mg BID daily for 2 weeks</td>
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<tr>
<td>Telmisartan</td>
<td>40mg daily for 2 weeks</td>
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<tr>
<td>Eprosartan</td>
<td>400mg, ½ tablet BID daily for two weeks</td>
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<tr>
<td>Olmesartan</td>
<td>20mg daily for two weeks</td>
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<td>8mg daily for 2 weeks</td>
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<td>300mg daily</td>
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<td>50mg BID daily</td>
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<td>80 mg BID daily</td>
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<td>400mg BID daily</td>
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<td>40mg daily</td>
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<td></td>
<td>Reevaluate patient as clinically indicated</td>
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</tbody>
</table>
BETA-Blocker Therapy

Does patient have evidence of active asthma with bronchospasm and/or Sick sinus syndrome without pacemaker and/or Partial or complete atrial ventricular block and/or Heart rate ≤ 60 or systolic BP supine or standing ≤ 90

Yes

No

Do not give Beta-Blocker

Unstable or decompensated heart failure

Yes

No

Treat with diuretic until patient euvolemic and cardiovascular status stable

Begin Beta-Blocker (See Page 17)
BETA-Blocker Therapy

Patient treated with ACE inhibitors (if tolerated), diuretic and digoxin for at least a month

Patient clinically stable for two to three weeks
NO other contraindications to Beta-Blocker (See Page 15)

Heart Range ≥ 60
And
Systolic Blood Pressure supine and standing > 90

Yes
Begin Beta Blocker at starting dose
(See Page 15)

No
Re-evaluate patient in two weeks

Re-evaluate patient in two weeks

Increased fatigue and/or lower exercise tolerance and/or weight gain
Consider increasing diuretic, keep B-Blocker at same dose if possible

Hypotension
Systolic BP ≤ 90

Hold diuretic 2 days then resume diuretic at ½ the original dose

Bradycardia
HR ≤ 50

Decrease Beta-Blocker By 50%

BMP 1 week after restarting diuretic

Patient Stable

Increase Beta-Blocker per protocol

Target dose Beta-Blocker attained
Bidil or Hydralazine (Apresoline) and Nitrates Therapy

Measure supine and standing blood pressure (BP)

Systolic BP < 90 supine and/or standing
- Do not begin Hydralazine/Nitrates
- Reevaluate patient in 2 weeks

Systolic BP ≥ 90 supine and standing
- Begin Bidil (See Page 20) or
  Hydralazine/Nitrates
  (See Page 19)
Hydralazine/Nitrates Therapy

Initial Doses
Apresoline 37.5 mg po tid
Isosorbide dinitrate 20mg tid

Reevaluate patient in 4 weeks

Systolic BP < 90 supine and/or standing

Yes
Hold diuretic 2 days then resume diuretic at ½ the original dose

No
Increase Apresoline to 75 mg po tid and Isosorbide dinitrate to 40 mg tid

Reevaluate patient as clinically indicated
Bidil

Initial Dose
Bidil one tablet po tid

Reevaluate patient in 4 weeks

Systolic BP < supine and/or standing

Yes

Hold diuretic 2 days then resume diuretic at ½ the original dose

Reevaluate patient as clinically indicated

No

Increase Bidil to two tablets tid
Aldosterone Antagonists

Serum K+ > 5.0 mEq/L
or
Creatinine > 2.5 mg/dL (male); > 2.0 mg/dL (female)
Or
Estimated Creatinine clearance < 30 ml/min
Or
Close monitoring of patient cannot be insured

Yes

No

Do not give Spironolactone

Potassium supplements should be discontinued or reduced

NSAIDS and COX-2 inhibitors should be avoided

Begin Spironolactone 12.5 mg po daily

Begin low potassium diet

Measure BMP level in 3 days, 1 week and 1 month

K > 5.0

Discontinue Spironolactone

K ≤ 5.0

Re-evaluate patient in 1 month

Are there side effects of gynecomastia, breast pain, menstrual irregularis or decreased libido? (Endocrine side effects)

Yes

No

Stop Spironolactone, begin Eplerenone

Increase Spironolactone to 25 mg po daily

Measure potassium level 3 days, 1 week and 1 month
Then every 3 months

K' > 5.0

Hold Spironolactone until K' < 5.0 then decrease Spironolactone to 12.5 mg po daily

K ≤ 5.0

Continue present dose Spironolactone

Measure potassium level 1 week and 1 month
Then every 3 months

K > 5.0

Discontinue Spironolactone

K < 5.0

Continue present dose Spironolactone
Continue evaluation for endocrine side effects

Endocrine side effects develop
No Endocrine side effects

See Page 22

Make sure patient not on potassium supplements, NSAIDS or COX-2 inhibitors
Aldosterone Antagonists

Begin Eplerenone 25 mg po daily

Measure potassium level in 3 days, 1 week and 1 month

K > 5.0
- Discontinue Eplerenone

K ≤ 5.0
- Re-evaluate patient in 1 month

Increase Eplerenone to 50 mg po daily

Measure potassium level in 3 days, 1 week and 1 month and every 3 months

K > 5.0
- Hold Eplerenone until K is < 5.0
- Decrease Eplerenone to 25 mg po daily

K ≤ 5.0
- Continue present dose Eplerenone

Patient on potassium supplement, NSAID or COX-2 inhibitor

Yes
- Discontinue potassium supplements, NSAIDS or COX-2 inhibitors

No
- Discontinue Eplerenone

Measure potassium level in 3 days, 1 week and 1 month

K > 5.0
- Patient on potassium supplement, NSAID or COX-2 inhibitor

K ≤ 5.0
- Continue present dose Eplerenone

Continue present dose Eplerenone

Measure K level in 3 months

Potassium supplements should be discontinued or reduced

Begin low potassium diet

NSAIDS and COX-2 inhibitors should be avoided

Make sure patient not on potassium supplements, NSAIDS or COX-2 inhibitors

Hold Eplerenone until K is ≤ 5.0
- Decrease Eplerenone to 25 mg po daily

Resume Eplerenone 25 mg daily

NSAIDS and COX-2 inhibitors should be avoided

Potassium supplements should be discontinued or reduced

Begin low potassium diet

NSAIDS and COX-2 inhibitors should be avoided

Make sure patient not on potassium supplements, NSAIDS or COX-2 inhibitors

Hold Eplerenone until K is ≤ 5.0
- Decrease Eplerenone to 25 mg po daily

Resume Eplerenone 25 mg daily

NSAIDS and COX-2 inhibitors should be avoided

Potassium supplements should be discontinued or reduced

Begin low potassium diet

NSAIDS and COX-2 inhibitors should be avoided

Make sure patient not on potassium supplements, NSAIDS or COX-2 inhibitors

Hold Eplerenone until K is ≤ 5.0
- Decrease Eplerenone to 25 mg po daily

Resume Eplerenone 25 mg daily
Congestive Heart Failure
Left Ventricular Diastolic Dysfunction

LVEF > 40

Pulmonary congestion and/or Peripheral Edema

Yes

Diuretic (See Page 4)

No

Hypertension

Yes

See Hypertension Protocol

No

Atrial Fibrillation

Yes

Able to restore to normal sinus rhythm

No

Digoxin (See Page 5)

Decrease Exercise Tolerance

Yes

No

Contraindication to Coumadin

No

Coumadin Per protocol

Yes

ECASA 81mg, one a day if no contraindication

Consider antiarrhythmic agent to prevent recurrent Atrial Fibrillation

Control ventricular rate