UAB SICU Atrial Fibrillation Guideline

Updated January 2022

Objectives:

The purpose of these inpatient care guidelines is to provide an evidence-based blue print for the acute care of patients with atrial fibrillation (AF) and atrial flutter (AFL) at the University of Alabama Birmingham. It is hoped that this standardization of care will result in improved patient outcomes, shorter length of ICU/hospital stay, standardization of cardiology consultation, and overall cost savings for the system. This document will discuss recommendations for electrical cardioversion of unstable patients with AF/AFL, pharmacologic cardioversion of AF and AFL (as well as contraindications), and management of anticoagulation.

Incidence:

Atrial fibrillation (AF) and atrial flutter (AFL) are the most common sustained arrhythmias in the U.S., affecting 2.5 million adults with the majority of patients over the age of 65. AF/AFL is associated with numerous comorbidities including hypertension, coronary artery disease, heart failure, and valvular heart disease. The cost of direct care of patients with AF in the U.S. is an estimated $6.65 billion annually, the majority of which is attributed to hospitalizations due to rapid ventricular response, heart failure, and stroke. New onset Atrial Fibrillation is seen in critically ill patients with variable frequency, from 4 to 15% in a surgical ICU[20]. The underlying pathophysiology and etiology of AF during critical illness differs from that of non-critically ill patients due to the potential for reversible factors including inflammation, electrolyte disturbance, adrenergic overstimulation, myocardial stretch, inappropriate oxygen delivery to the myocardium, and the use of proarrhythmic drugs.

Summary of Recommendations:

Atrial fibrillation is a common postoperative arrhythmia and can represent a major source of morbidity and mortality. Treatment of atrial fibrillation is directed at three main objectives: controlling the ventricular response, preventing thromboembolism, and maintaining sinus rhythm. Therapeutic decisions also hinge on patients' hemodynamic stability. In patients who are hemodynamically unstable, direct current cardioversion is the first line therapy and pharmacotherapy should be used as adjunctive treatment. In patients who are hemodynamically stable, pharmacologic treatment including class II (beta-blockers), class III (amiodarone), or class IV (nondihydropyridine calcium channel blockers) agents are viable options.

In the setting of normotension and grossly intact systolic function (EF>35%) beta blockade should be utilized first line. Beta blockade is superior to calcium channel blockers (AFFIRM trial: 70% control with BB vs 54% control with CCB) and thusly should be first line in those patients with grossly normal systolic function[12]. If beta-blockade therapy is unsuccessful, then second line regimen should be chosen based on blood pressure (CCB vs amiodarone). If the patient is normotensive, then calcium channel blockers may be utilized. If the patient is relatively hypotensive (SBP <110mmhg) or has labile blood pressure, then calcium channel blockers should be avoided. In this setting, amiodarone should be utilized. CCB may be more effective than amiodarone in regards to 24hr rate control, but are associated with a higher incidence of hypotension (30%) [13].

In the setting of patients with confirmed or suspected acute-onset gross systolic dysfunction, amiodarone should be utilized first line. If amiodarone bolus therapy is successful*, then a drip should be initiated. This should be converted to oral regimen when able/after 24hours. Should amiodarone therapy be unsuccessful in the setting of acute-onset gross systolic dysfunction, cardiology consult should be obtained and digoxin therapy considered. Because of their negative inotropic effect, calcium channel antagonists may further decompensate patients with left ventricular systolic dysfunction and symptomatic heart failure. In the absence of gross systolic dysfunction (EF<35%) beta blockade and calcium channel blockers may be utilized.

When rate control is compared to rhythm control, they have equal outcomes in regards to mortality however rhythm control strategies lead to increased hospitalizations[15,16]. Thusly, a rate control strategy generally should be the goal. However, a rhythm control strategy should be considered in the following patients: young (<65yo), first episode of AF, AF precipitated by acute illness/trauma. Also, those patients whom it is difficult to obtain rate control

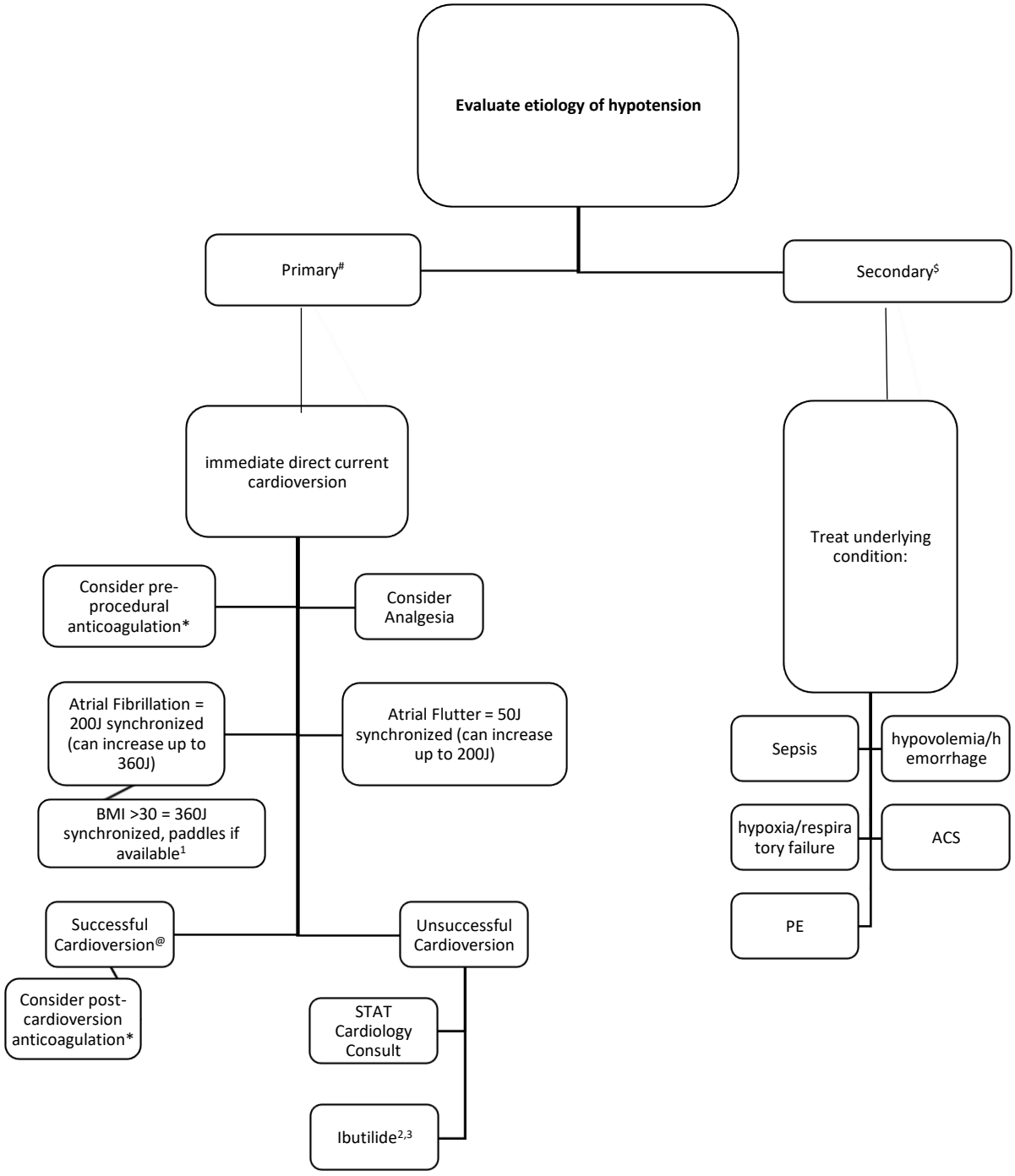
and those patients who have tachycardia mediated cardiomyopathy. It is the recommendation of this protocol in an acute setting of AF/AFL with RVR, to first establish rate control and then assess if the patient would benefit from further rhythm control, and a cardiology consult should be sought.

Clinical Practice Guideline

I. Diagnosis/Workup - For patients with tachycardia (>120bpm) and irregular rhythm concerning for atrial fibrillation:

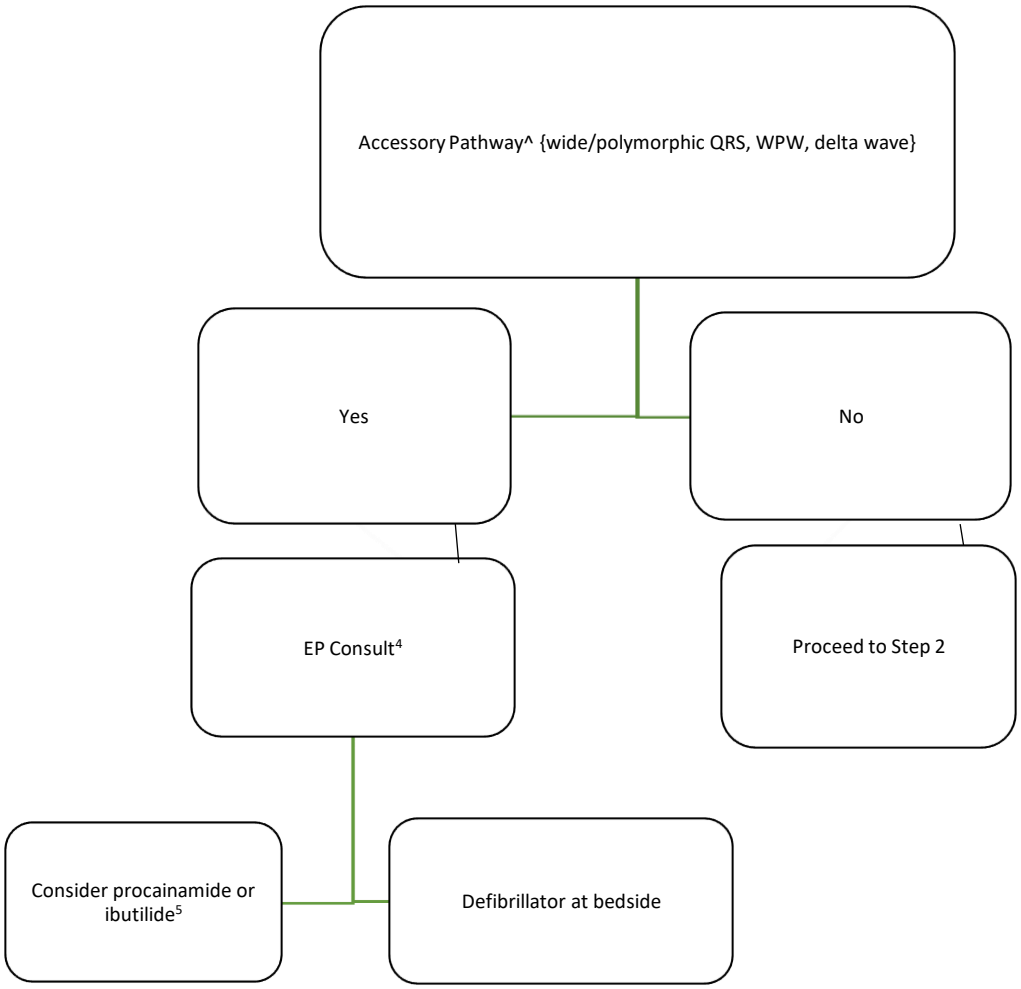
1. EKG to confirm Atrial Fibrillation with Rapid Ventricular Rate, HR >120bpm
    a. **Evaluate for accessory pathway** (Figure 2a) and contraindications for pharmacologic management
2. Obtain CBC, BMP, Mg, Ph, TSH
    a. Optimize electrolytes
3. Obtain Troponin if ST changes on EKG or chest pain
    b. If evidence of rate-related ischemia obtain cardiology consult & follow cardioversion algorithm (Figure 1)
4. CXR & BNP to evaluate for volume overload
5. Echo to evaluate for structural heart disease and/or heart failure
    c. Consider POCUS to evaluate for gross assessment of EF [8-11]
    d. If evidence of acute heart failure (pulmonary edema, respiratory distress, grossly diminished EF): cardiology consult & cardioversion algorithm (Figure 1)
6. Assess Blood Pressure
    e. Hypotension (SBP <90) – proceed with cardioversion algorithm (Figure 1)
        i. Transfer patient to ICU setting
    f. Normotension (SBP>90) – proceed with pharmacologic algorithm (Figure 2)
        i. Continuous telemetry, transfer to step down or ICU
        ii. Dosing to follow medication dosing (table 1)

Cardioversion algorithm
(Figure 1)



Primary hypotension – hypotension directly related to rapid ventricular rate
$ Secondary Hypotension – underlying condition leading to hypotension, exclusive of rapid ventricular rate
@ Successful cardioversion – return to sinus rhythm
*See anticoagulation algorithm

Step 1: Evaluate for Accessory Pathway
(Figure 2a)



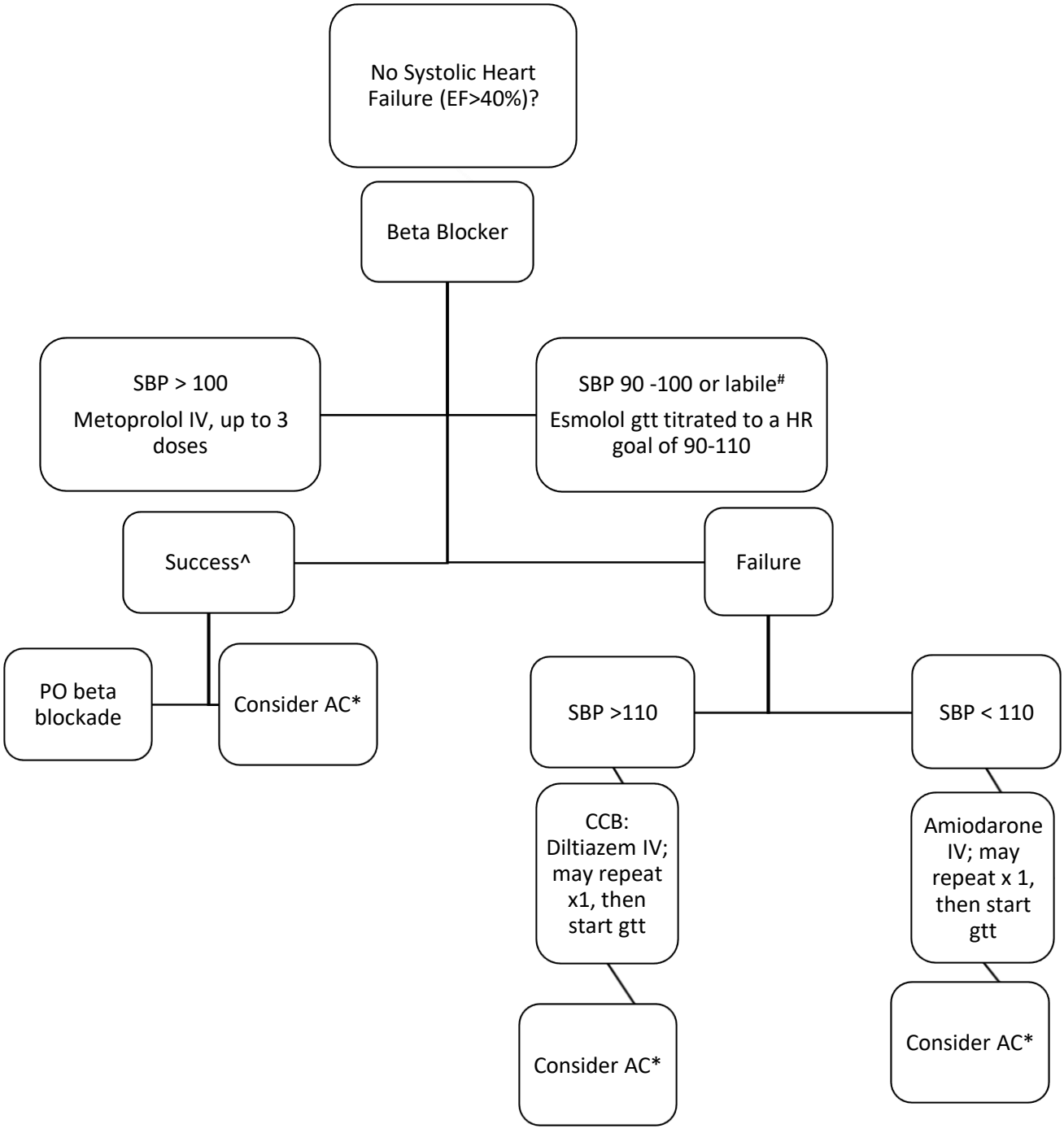
^Wolff Parkinson White (WPW) - Hallmark ECG findings include short PR interval and prolonged QRS (>.12s) with an initial slurring upstroke ("delta" wave). If accessory pathway suspected or confirmed, consult cardiology/EP. Many anti-arrhythmic are contraindicated in the setting of an accessory pathway.

[4] Many anti-arrhythmics are contraindicated in the setting of an accessory pathway. AV nodal blocking agents (BB, CCB, Digoxin) can be fatal – accelerates anterograde conduction through the accessory pathway to the extent that ventricular fibrillation occurs

[5] In the setting of an accessory pathway or pre-excitation syndrome Procainamide (50-100mg every 2-5 min to a max of 17mg/kg OR 1 gram, whichever is less) or ibutilide (0.01mg/kg max 1mg over 10 min) are the treatment of choice for chemical conversion.

Step 2: Evaluate for heart failure

(Figure 2b)

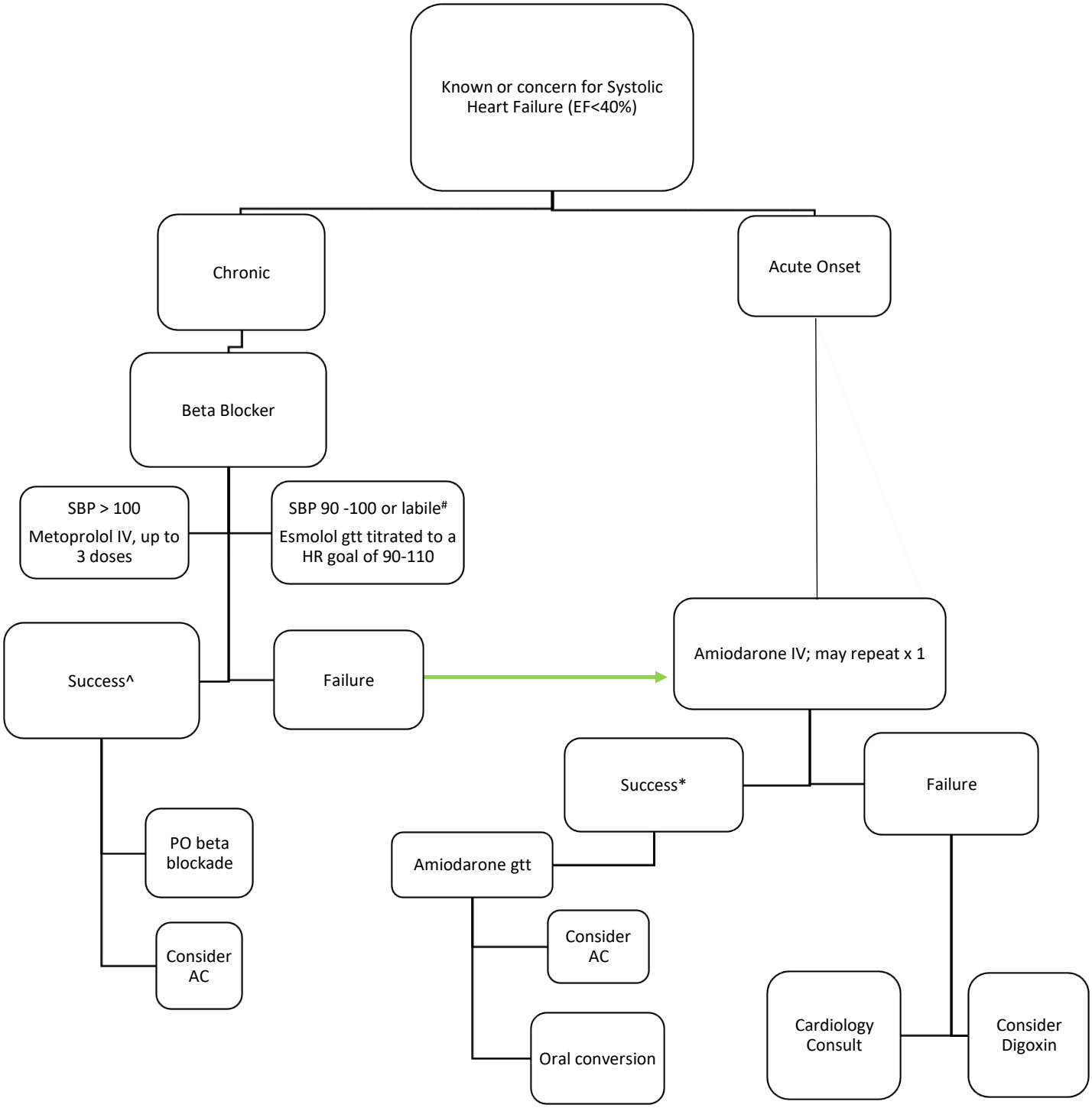


in those patients with a systolic blood pressure below 100 or with labile blood pressure consider utilization of esmolol given shorter half-life and ability to titrate.

^Successful pharmacologic management – HR <110bpm acutely. Prior to discharge a HR <110bpm for patients with preserved LV function[17] or <80bpm for patients with diminished LV function[14]

*See anticoagulation algorithm

Step 2: Evaluate for heart failure
(Figure 2c)



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*See anticoagulation algorithm

Step 3: Consider the appropriateness of a rhythm control strategy

After rate control is achieved acutely, a therapeutic goal of restoring normal sinus rhythm should be pursued for patients that meet all of the following criteria:

1. Young (<65yo)
2. First Episode of Atrial Fibrillation
3. Atrial Fibrillation precipitated by acute illness

Management of patients meeting above criteria:

1. If rhythm control was restored with medications above, continue medication (BB, CCB, Amio) and outpatient cardiology referral.
2. If rate control is achieved, but remains in atrial fibrillation, inpatient cardiology consult for rhythm control strategy.

Medication Dosing (Table 1)

	Drug	Warnings/contraindications	IV Dosing	PO Dosing	Notes
Calcium Channel Blockers	Diltiazem	AV Nodal block Negative inotrope Vasodilator CI: Systolic Heart Failure	0.15-0.25mg/kg (10-20mg; max 25mg) IVP bolus over 2 min, consider 2nd bolus 15 minutes later. Start infusion at 5mg/hr, titrate by 2.5mg/hr every 30 min for maximum dose 15mg/hr [onset 2-7 min]	120-360mg daily divided doses [onset 2-4 hours]	
	Verapamil		2.5 – 5mg IVP over 2 min, second dose of 5-10mg may be given 15-30 min after initial dose, max total dose 20-30mg [onset 3-10 min]	120 -360mg daily divided doses [onset 1-3 hours]	
Beta Blockers	Metoprolol	AV Nodal block Caution with decompensated heart failure	5mg IVP every 5-20 min x 3 [onset 5 min]	If conversion after 5mg IV → 25mg PO BID. 10mg IV → 50mg PO BID. 15mg IV → 75 PO BID [onset 4-6 hours]	
	Esmolol	AV Nodal block Caution with decompensated heart failure	50mcg/kg/min, titrated upward in 50mcg/kg/min Q5 min to max of 300mcg/kg/min [onset <5min]		Short half-life, better for tenuous BP
Other	Amiodarone	Pulmonary toxicity; Thyroid toxicity	150mg IV over 10 min, consider second dose for non-response. 1mg/min IV x 6 hours, 0.5mg/min IV x 18 hours	600 to 800 mg per day in divided doses until a total of 10 g has been given; then 200 mg per day	Anti-arrhythmic Useful in pts with decompensated heart failure
	Digoxin	AV nodal block Renal impairment increases the risk of drug accumulation CI: ESRD	IV loading: 8-12mcg/kg IBW, administer load in 3 doses as 50%, 25%, 25% Q 6 hours.	Loading dose: 10-15mcg/kg IBW, administer load in 3 doses as 50%, 25%, 25% Q 6 hours.	Therapeutic drug monitoring recommended to reduce risk of adverse events Steady state @ 5-7 days

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Anticoagulation Therapy Guideline

Introduction:

Regardless of the strategy of symptom control, every patient with AF/AFL needs to be evaluated for thromboembolic risk. Maintenance of anticoagulation in the immediate setting is critical to prevent systemic thromboembolism including stroke following pharmacologic or electrical cardioversion, which occurs within the first 3 days of restoration of sinus rhythm[1].

I. Indications
   a. Elective cardioversion under cardiology guidance, no recommendations per this guideline.
   b. Cardioversion for Instability
      i. <48 hours
         1. No need for anticoagulation if <48hours and CHA_2DS_2-VASc Low (see below)
      ii. >48hrs or unknown
         1. Anticoagulate as soon as possible, continue for 4 weeks.
         2. No need for pre-cardioversion TEE in the setting of instability.
         3. Ensure follow up with cardiology outpatient
   c. CHA_2DS_2-VASc (Appendix A)
      i. For patients with AF and an elevated CHA_2DS_2-VASc score of 2 or greater in men or 3 or greater in women, oral anticoagulants are recommended (see below).

II. Contraindications
   a. Absolute contraindications:
      i. Major active bleeding (bleeding requiring > 2 units PRBC transfusion, decrease in hemoglobin by ≥ 2 g/dL, or bleeding in a critical area or organ)
      ii. Platelets < 25 K/microliter
      iii. Spinal procedure and/or epidural placement
      iv. Severe uncontrolled malignant hypertension
   b. Relative contraindications:
      i. Brain metastases with higher risk of bleeding (renal, choriocarcinoma, melanoma, thyroid cancer)
      ii. Intracranial or central nervous system (CNS) bleeding within the past 4 weeks
      iii. Recent high-risk surgery or bleeding event
      iv. Active but non-life threatening bleeding
      v. Active gastrointestinal (GI) ulceration at high risk of bleeding
      vi. Platelets < 50 K/microliter, consider consult to Benign Hematology

III. Assessing Bleeding Risk
   a. HAS-BLED [6] (Appendix B)
      i. ≥3 high risk of bleeding
         1. Correct modifiable factors
         2. If still ≥3, anticoagulation per attending discretion
            a. Consider lower dose DOAC
               i. In patients with atrial fibrillation, dabigatran given at a dose of 110 mg was associated with rates of stroke and systemic embolism that were similar to those associated with warfarin, as well as lower rates of major hemorrhage[7].
      ii. HAS-BLED score > CHA_2DS_2-VASc
         1. Correct modifiable factors
         2. If still ≥3, anticoagulation per attending discretion
            a. Consider lower dose DOAC

i. In patients with atrial fibrillation, dabigatran given at a dose of 110 mg was associated with rates of stroke and systemic embolism that were similar to those associated with warfarin, as well as lower rates of major hemorrhage[7].

IV. Anticoagulation Therapy Options & Dosing (Table 1, Table 2)

a. First-Line, Acute
    i. Heparin
b. Second-Line, Acute
    i. Lovenox[8]
        1. Enoxaparin is noninferior to UFH for prevention of ischemic and embolic events, bleeding complications, and death in TEE-guided cardioversion of atrial fibrillation. Its easier application and more stable anticoagulation may make it the preferred drug for initiation of anticoagulation in this setting[8].
c. First- Line, Oral
    i. Direct-acting Oral Anticoagulants (DOACs) (dabigatran, rivaroxaban, apixaban, and edoxaban) are recommended over warfarin in DOAC-eligible patients with AF (except with moderate-to severe mitral stenosis or a mechanical heart valve).
        1. For patients with diminished CrCl, discuss with pharmacy regarding reduced doses of direct thrombin or factor Xa inhibitors.
        2. Dabigatran, Rivaroxaban, Edoxaban are not recommended in ESRD
d. Second-Line, Oral
    i. Warfarin
e. Special Populations
    i. In patients with moderate – severe mitral stenosis or a mechanical heart valve, Warfarin is preferred.
    ii. Patients on DAPT for prior PCI
        1. Patients who require dual antiplatelet therapy for percutaneous coronary intervention (PCI) AND with AF at increased risk of stroke (based on above CHA_2DS_2-VASc) triple therapy (oral anticoagulant, aspirin, and P2Y12 inhibitor) should be prescribed
            a. Clopidogrel is preferred over prasugrel.
            b. Transition to double therapy (oral anticoagulant and P2Y12 inhibitor) at 4 to 6 weeks, per cardiology outpatient follow up
        2. In patients with AF at increased risk of stroke (based on CHA_2DS_2-VASc risk score of 2 or greater) who have undergone PCI with stenting for ACS, double therapy with P2Y12 inhibitors (clopidogrel) and low-dose rivaroxaban (15 mg daily) is reasonable to reduce the risk of bleeding as compared with triple therapy.

Appendix A: CHA_2DS_2-VASc

CHA_2DS_2-VASc	Score
Congestive heart failure	1
Hypertension	1
Age ≥75 y	2
Diabetes mellitus	1
Stroke/TIA/TE	2
Vascular disease (prior MI, PAD, or aortic plaque)	1
Aged 65 to 74 y	1
Sex category (ie, female sex)	1
Maximum score	9

Appendix B: HAS-BLED

HAS-BLED	Score
Hypertension (systolic blood pressure >160 mm Hg)	1
Abnormal renal and liver function* (1 point each)	1 or 2
Stroke	1
Bleeding tendency/predisposition*	1
Labile INRs (if on warfarin)*	1
Elderly (eg, age >65 y)	1
Drugs or alcohol (1 point each)*	1 or 2
Maximum score	9

Figure 1: Anticoagulation Algorithm

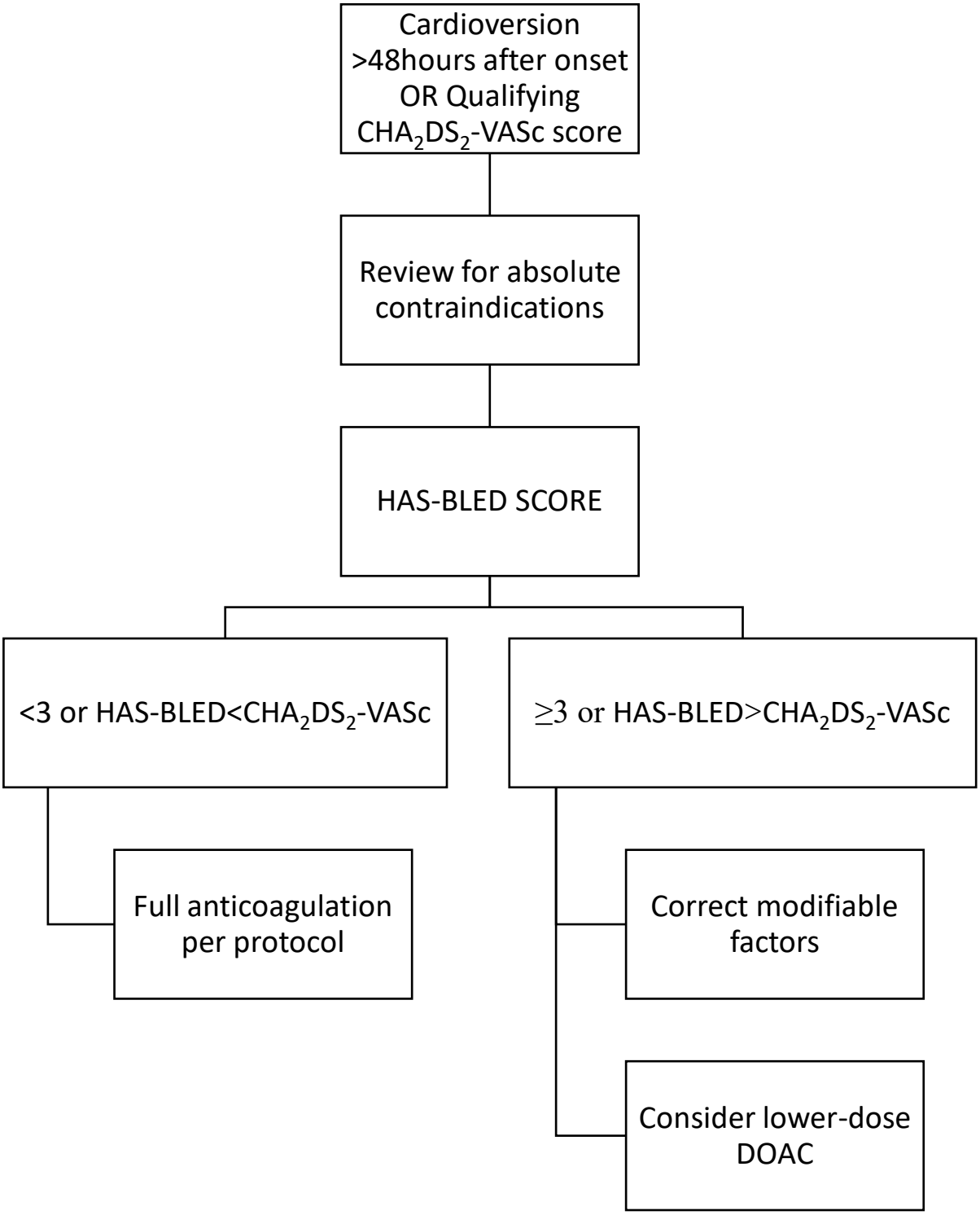

Table 1: IV Anticoagulation Dosing

MOA	Drug	Warnings/contraindications	Dosing	Notes
Factor Xa and thrombin inhibitor	Unfractionated Heparin	Contraindicated: History of heparin induced thrombocytopenia; Uncontrolled active bleeding	Use Powerplan: Heparin Infusion for Cardiac Indications: 70 units/kg bolus (optional); 15units/kg/hr titrated to anti-Xa 0.3-0.7	For patients with exposure to DOACs in the past 48-72 hours, select PTT titration option within the powerplan
Factor Xa inhibitor and mild thrombin inhibitor	Enoxaparin	Contraindicated: History of heparin induced thrombocytopenia; Uncontrolled active bleeding	1mg/kg SubQ BID CrCl: <30mL/min 1mg/kg Daily	Requires dose adjustment for renal dysfunction;
Direct Thrombin Inhibitors	Bivalirudin	Contraindicated: Uncontrolled active bleeding;	0.15mg/kg/hr; CrCl 30-59 mL/min: 0.08 mg/kg/hr CrCl 10-29mL/min: 0.04mg/kg/hr IHD/CVVHDF: 0.07mg/kg/hr	Titrated to PTT 1.5-2.5x control For use in patients with HIT or history of HIT or ATIII deficiency with demonstrated heparin resistance

Table 2: Oral Anticoagulation

MOA	Drug	Warnings/contraindications	PO Dosing	Notes
Vitamin K Antagonist	Warfarin	Contraindicated: Uncontrolled active bleeding; epidural analgesia; Pregnancy Warnings: dosing subject to major drug-drug and drug-food interactions	Initial dosing: 2.5–10 mg every 24 h	titrated to range INR: 2.0–3.0; target of 2.5
Direct factor Xa Inhibitors	Rivaroxaban	Contraindicated: Uncontrolled active bleeding	CrCl >50 mL/min: 20 mg once daily CrCl 15–50 mL/min: 15 mg once daily	No coagulation specific monitoring recommended
	Apixaban	Contraindicated: Uncontrolled active bleeding	5 mg twice daily 2.5 mg twice daily in patients with at least two of: age >80 years, body weight <60 kg, serum creatinine <1.5 mg/dL	Dose adjustments required for patients receiving concomitant ketoconazole, itraconazole, or ritonavir
Thrombin Inhibitor	Dabigatran	Contraindicated: Uncontrolled active bleeding; Mechanical prosthetic heart valve	CrCl >30 mL/min: 150 mg twice daily CrCl 15–30 mL/min: 75 mg twice daily May consider 110mg BID dosing for patients with higher bleeding risk	Dose adjustments required for patients receiving concomitant ketoconazole or dronedarone

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