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Beta-Blockers vs Calcium Channel Blockers for Atrial Fibrillation in the ED

Introduction

1. Atrial Fibrillation is the most common sustained arrhythmia seen in the emergency department and requires emergent treatment to prevent myocardial ischemia and acute heart failure.
2. Beta-blockers and calcium channel blockers are used for acute rate control in the treatment of atrial fibrillation with rapid ventricular response.

Pharmacology

	Metoprolol	Diltiazem
MOA	Competitive beta$_1$- adrenergic receptor inhibitor (cardio-selective); decreased contractility, heart rate, and cardiac conduction time, increased relaxation	Non-dihydropyridine CCB selective to L-type calcium channel in cardiac cells; decreased heart rate and conduction time, increased vasodilation
Dose	• 2.5-5mg IV • Repeat every 5 minutes as needed • Max total dose of 15mg	• Bolus: 0.25mg/kg IV • Repeat 0.35mg/kg after 15 minutes if needed • After bolus: continuous infusion 5-10mg/hr IV, max 15mg/hr or PO IR 30-90 mg
Administration	IV bolus over 2 minutes	IV bolus over 2 minutes
PK/PD	• **Onset:** 1-2 minutes • **Peak:** 20 minutes • **Metabolism:** hepatic CYP2D6 • **Half-life:** 3-4 hours	• **Onset:** 3 minutes with IV bolus • **Duration:** 1-3 hours with IV bolus, 0.5-10 hours after cessation of continuous infusion • **Metabolism:** hepatic CYP3A4 and conjugation • **Half-life:** ~3.5 hours with bolus, 4-5 hours with continuous infusion
Adverse Effects	• Bradycardia • Hypotension • AV block • Bronchospasms at doses >100mg • CNS effects- fatigue, depression, sleep disturbance	• Bradycardia • Peripheral edema • Hypotension • AV block
Drug Interactions and warnings	• Avoid in decompensated heart failure • Masks symptoms of hypoglycemia and hyperthyroidism	• Symptomatic hypotension • Mild AST/ALT elevations • Avoid in heart failure
Compatibility	Compatible with NS or D5W	Compatible with NS, D5W, or D5-1/2NS
Comments	Abrupt cessation can result in angina and MI	Continuous infusions should not be continued beyond 24 hours due to accumulation

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Overview of Evidence

Author, year	Design/ sample size	Intervention & Comparison	Outcome
Hargrove, 2021	Retrospective (n=51)	• Diltiazem • Metoprolol	• **No difference regarding sustained rate control for 3 hours** (diltiazem 87.5% vs metoprolol 78.9%) • Shorter time to rate control with diltiazem (15min vs 30min) • No differences in bradycardia or hypotension
Hirschy, 2019	Retrospective cohort (n=48)	• Diltiazem IV push • Metoprolol IV push	• **No difference in successful rate control within 30 minutes in patients with HFrEF** (diltiazem 50% vs metoprolol 62%) • No differences in hypotension, bradycardia, conversion, or signs of worsening heart failure
Hines, 2016	Retrospective cohort (n=100)	• Diltiazem • Metoprolol	• **Predictors for initial selection of metoprolol over diltiazem included past history of atrial fibrillation, diabetes, and prescription for BB prior to ED visit** • **Prescription of CCB prior to ED visit was a negative predictor for metoprolol use in the ED** • No differences in efficacy or safety
Kuang, 2016	Retrospective cohort (n=398)	• BB naïve patients • Patients on chronic BB therapy	• **BB naïve patients achieved successful rate control at higher rates than those on chronic BB therapy** (56.1% vs 42.4%) and had shorter LOS (1.79 days vs 2.64 days)
Martindale, 2015	Systematic review (n=92)	• Diltiazem • Metoprolol	• **In the ED, diltiazem is more effective at rapidly controlling ventricular rates than metoprolol** • Administration of calcium prior to diltiazem does not prevent hypotension
Fromm, 2015	Prospective, randomized, double blind (n=52)	• Diltiazem 0.25mg/kg (max 30mg) • Metoprolol 0.15mg/kg (max 10mg)	• **Diltiazem decreased heart rate more rapidly and substantially within first 30min** • No differences in hypotension and bradycardia
Scheuermeyer, 2013	Retrospective cohort (n=259)	• CCB: diltiazem or verapamil • BB: metoprolol or atenolol	• **No difference in admission rates, length of stay, adverse events, and 7 or 30-day ED revisits** between CCB and BB
Demircan, 2005	Prospective, randomized (n=40)	• Diltiazem 0.25mg/kg (max 25mg) • Metoprolol 0.15mg/kg (max 10mg)	• Successful rate control (HR <100bpm, decrease by 20%, or return to sinus rhythm) was higher with diltiazem at 2 minutes • **Successful rate control was similar at 20 minutes (diltiazem 90% vs metoprolol 80%)** • No incidences of hypotension

Conclusions

1. Diltiazem has a quicker onset of action and therefore a faster onset to rate control but is not correlated with a significant difference in long-term outcomes.
2. Both medications are appropriate options for treatment of acute rate control, and treatment choice should be based on patient specific factors such as comorbidities, drug interactions, and prior therapy.

References

1. Micromedex [Electronic version]. Greenwood Village, CO: Truven Health Analytics. Retrieved February 17, 2021, from http://www.micromedexsolutions.com/
2. Lexicomp [Electronic version]. Macedonia, OH: Truven Wolters Kluwer Health. Retrieved February 19, 2021. https://online.lexi.com/lco/action/login.
3. Hargrove KL, Robinson EE, Lusk KA, et al. Comparison of sustained rate control in atrial fibrillation with rapid ventricular rate: Metoprolol vs. Diltiazem. *Am J Emerg Med.* 2021; 40:15-19.
4. Hirschy R, Ackerbauer KA, Peksa GD, O'Donnell EP, DeMott JM. Metoprolol vs. diltiazem in the acute management of atrial fibrillation in patients with heart failure with reduced ejection fraction. Am J Emerg Med. 2019 Jan;37(1):80-84. PMID: 29731345.
5. Hines MC, Reed BN, Ivaturi V, Bontempo LJ, Bond MC, Hayes BD. Diltiazem versus metoprolol for rate control in atrial fibrillation with rapid ventricular response in the emergency department. Am J Health Syst Pharm. 2016 Dec 15;73(24):2068-2076. PMID: 27919874.
6. Kuang P, Mah ND, Barton CA, Miura AJ, Tanas LR, Ran R. Achieving ventricular rate control using metoprolol in β-blocker-naive patients vs patients on chronic β-blocker therapy. Am J Emerg Med. 2016 Mar;34(3):606-8. PMID: 26830391.
7. Martindale JL, deSouza IS, Silverberg M, Freedman J, Sinert R. β-Blockers versus calcium channel blockers for acute rate control of atrial fibrillation with rapid ventricular response: a systematic review. Eur J Emerg Med. 2015 Jun;22(3):150-4. PMID: 25564459.
8. Fromm C, Suau SJ, Cohen V, et al. Diltiazem vs. metoprolol in the management of atrial fibrillation or flutter with rapid ventricular rate in the emergency department. *J Emerg Med.* 2015; 49(2):175-182.
9. Demircan C, Cikriklar HI, Engindeniz Z, et al. Comparison of the effectiveness of intravenous diltiazem and metoprolol in the management of rapid ventricular rate in atrial fibrillation. *Emerg Med J.* 2005; 22:411-414.
10. Scheuermeyer FX, Grafstein E, Stenstrom R, et al. Safety and efficacy of calcium channel blockers versus beta-blockers for rate control in patients with atrial fibrillation and no acute underlying medical illness. *Acad Emerg Med.* 2013; 20(3):222-230.