

Rate control with intravenous diltiazem, metoprolol, and verapamil in atrial fibrillation with rapid ventricular rate

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Background

- ❖ Diltiazem is one of the preferred agents for rate control in atrial fibrillation (AF) due to its quick onset, minimal side effect profile, and low cost
- ❖ Due to intermittent shortage of intravenous diltiazem since February 2018, there has been an increase in utilization of IV metoprolol and verapamil
- ❖ Although diltiazem and metoprolol have been studied extensively for rate control in patients AF with rapid ventricular rate (RVR), results have been variable
- ❖ Current literature includes very few studies looking at the effectiveness of verapamil in achieving rate control in patients with AF with RVR

Objective

- ❖ Investigate the effect of IV diltiazem, metoprolol, and verapamil on rate control in patients with AF with RVR

Methods

- ❖ Retrospective, single-center, cohort chart review study approved by Texas Tech University Health Science Center (TTUHSC) IRB
- ❖ Study Site: Hendrick Medical Center (HMC) - a 564-bed, 22-ICU bed community hospital in Abilene, Texas
- ❖ Study subjects identified by ICD codes and charge codes during time period of January 1, 2012 to August 31, 2018

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none">- Age ≥ 18 years- Diagnosis of AF with RVR- AF symptom onset within <48 hours- Seen at HMC between Jan 1, 2012 and Aug 31, 2018- Prescribed IV diltiazem, metoprolol, or verapamil for rate control	<ul style="list-style-type: none">- ≥90 years- Pregnancy- Prisoners- Incomplete medical records

Study Outcomes

- ❖ **Primary:** Percent of patients with successful ventricular rate control <100 bpm within 1 hour of treatment
- ❖ **Secondary:** Time to achieve ventricular rate control <100 bpm, HR at 30 min and 1 hour after administration of rate control agent, incidence of adverse effects (bradycardia, hypotension), percent of patients requiring agents other than initial study drug for acute rate control, percent of inpatient admission, duration of hospital stay, ICU mortality, hospital mortality

Statistical Analysis

- ❖ **Continuous data:** One-way ANOVA test, Kruskal-Wallis test
- ❖ **Nominal data:** Chi-square test, Fisher’s exact test
- ❖ Multiple logistic regression analysis models to assess differences between study groups
 - **Covariates:** Age, weight, height, BMI, baseline HR, baseline BP, APACHE II score, Charlson comorbidity index
- ❖ A p-value of less than 0.05 is considered significant

Results

Demographics	Diltiazem (n=51)	Metoprolol (n=15)	Verapamil (n=12)
Mean age, yr	69	73	70
Male sex, no (%)	22 (43.2)	8 (53.3)	5 (41.7)
Mean weight, kg	85.2	84.9	107
Mean HR, bpm	140	137	151
Mean SBP, mmHg	137	123	143
Mean DBP, mmHg	89	75	98
Heart valve replacement, no (%)	1 (2.0)	0 (0.0)	1 (8.3)
Pacemaker, no (%)	13 (25.5)	0 (0.0)	1 (8.3)
Home medications			
Beta blocker, no (%)	21 (41.2)	11 (73.3)	8 (66.7)
Non-DHP CCB, no (%)	7 (13.7)	2 (13.3)	1 (8.3)
Digoxin, no (%)	3 (5.9)	0 (0.0)	0 (0.0)
Other	24 (47.1)	3 (20.0)	3 (25.0)
Median CACI score, no.	5	6	4
Location			
ED, no (%)	48 (94.1)	13 (86.7)	12 (100.0)
Inpatient, no (%)	3 (5.9)	2 (13.3)	0 (0.0)
Received rate control agent from EMS, no (%)	3 (5.9)	1 (6.7)	1 (8.3)
Dose of rate control agent			
Mean first dose, mg	14.5	4.7	7.5
Mean total dose, mg	38.3	7	19.8

Primary Outcome

	Diltiazem (n=51)	Metoprolol (n=15)	Verapamil (n=12)
Achieved ventricular rate less than 100 beats per minute within 1 hour of treatment, no (%)	16 (31.4)	3 (20.0)	5 (41.7)

Secondary Outcomes

	Diltiazem (n=51)	Metoprolol (n=15)	Verapamil (n=12)
Median time to achieve ventricular rate less than 100 beats per minute, minutes	166	297	101
Mean heart rate at 1 hour after administration of rate control agent, beats per minute	115	113	103
Incidence of bradycardia after administration of rate control agent, no (%)	1 (2.0)	0 (0.0)	1 (8.3)
Incidence of hypotension after administration of rate control agent, no (%)	7 (13.7)	3 (20.0)	1 (8.3)
Required rate control agent other than initial rate control agent used, no (%)	10 (19.6)	8 (53.3)	0 (0.0)

Discussion

- ❖ **Strengths:** First study comparing three different rate control agents against each other, multiple regression analysis
- ❖ **Limitations:** Single-center retrospective chart review, physician preference of rate control drugs, documentation in emergency department not as accurate as inpatient

Conclusion

- ❖ Metoprolol and verapamil administration led to similar outcomes in rate control when compared to diltiazem
- ❖ Metoprolol had the longest time to achieve rate control
- ❖ Results from this study can be helpful to clinicians during future drug shortages

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