

# Marijuana and its Cardiovascular Effects: A Systematic Review

Authors: Charlene Y Clements MD, MPH; Charity A Reynolds MD; Aiden Abidov MD, PhD, FACC, FAHA, FASE; Maegan Lopez; Ciara A Lugo; Youlisa Gonzalez

## Introduction

With the current momentum sweeping the country regarding the usage of marijuana as a medical therapy, limited pooled data exists regarding the potential adverse cardiovascular effects associated with the inhalation or ingestion of marijuana. Nationwide legalization of medical marijuana impacts multiple people including physicians, dispensaries, emergency departments, and the consumer. Physicians should be aware of the effects of marijuana in order to better inform their patients. Marijuana use continues to grow in the United States with an estimated 2-15 million users annually. Our review concentrated on the cardiovascular effects of marijuana as cardiovascular disease remains the leading cause of death globally with 17.3 million deaths estimated per year.

## Methods

We did a literature review using MEDLINE/PubMed, searched for marijuana, heart, hemodynamic and cardiovascular effects. We searched only English written articles between 1/1/1996 to 5/4/2015. Article types were case reports, clinical trials, historical articles and observational studies. Inclusion criteria: Human subjects, Inhaled marijuana/cannabis, cardiovascular/hemodynamic system effect as outcome. We retrieved 115 articles, 21 were non-relevant, 49 were unclear subject matter, therefore leaving 45 articles for the review. Review included 12 placebo controlled randomized studies, 3 experimental studies, 3 cohort studies, 1 longitudinal study, 1 prospective study, 3 case series studies, 20 case reports, 2 case crossover studies. The total number of patients exposed to marijuana was 49,877 individuals.

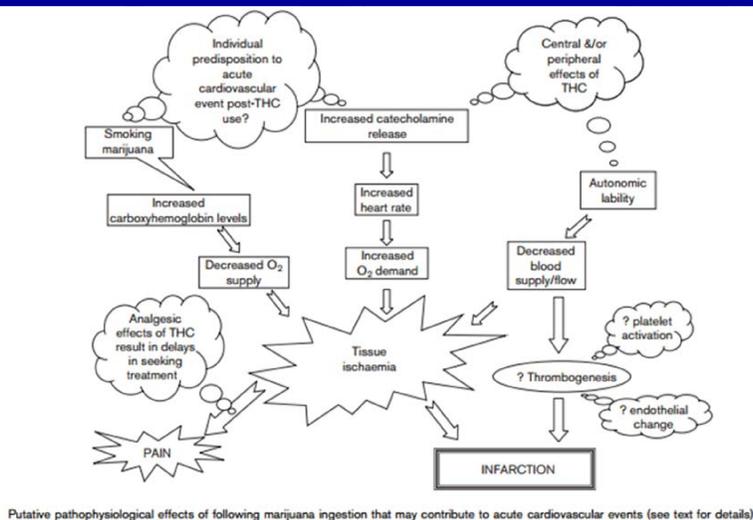
## Results

Rhythm abnormalities, were identified as the most common side effect over placebo controls after ingestion/inhalation. In 17/45 studies, sinus tachycardia was the most common rhythm abnormality, hypothesized to be related to THC increasing sympathetic activity. This is noted to be dose related. Atrial arrhythmias occurred in 8/20 case reports, most common being atrial fibrillation. Ventricular tachycardia was reported in 2 cases. Syncope and dizziness associated with marijuana exposure are reported as symptoms across various studies. Gorelick and colleagues suspect that THC levels in the blood lead to acute hypotension secondarily to activation of cannabinoid receptors in the arterial wall causing vasodilatation.

## Results (Cont.)

We identified 15 case reports with myocardial infarction associated with marijuana use (Table 1.) Notably, the most common reported form of myocardial infarction after exposure to marijuana was STEMI (12 out of the 15 reports). One proposed mechanism of these sudden coronary occlusions was likely a disruption of a plaque secondary to the acute hemodynamic changes that marijuana causes on the cardiovascular system. As THC is known to bind on the CB1 and CB2 receptors, this may additionally influence thrombus formation by leading to platelet aggregation. In 12 of the 20 case reports (60%), evidence of thrombus formation were detected during subsequent cardiac catheterizations and autopsies.

**Figure 1. Pathophysiological Effects Following Marijuana Exposure (From Caldicott, 2005)**



Putative pathophysiological effects of following marijuana ingestion that may contribute to acute cardiovascular events (see text for details).

**Table 1. Results**

Study Types	Total # of Patients Sex/Ages	Hemodynamic Effects	CV Effects
20 Case reports	17 Men 4 Women 13-50 y.o	A.fib/A. flutter/V. Tach/V. Fib HTN	STEMI, thrombosis
3 Case series	3 Men 2 Women 20-50 y.o	Hypotension, shock, asystole	STEMI, NSTEMI, V. fib, Cardiac hypertrophy
3 Cohort studies	45,915	V. fib	CHD higher mortality rates after MI
1 Longitudinal study	3,617	HTN	
1 Prospective study	36	Tachycardia, HTN	
1 Case Crossover study design	3,882 patients	None	Acute MI
3 Experimental	189	Tachycardia, HTN	
12 Placebo Controlled Double Blind Study	298	Tachycardia	

## Conclusions

Our systematic review provides an important collection of data regarding existing evidence of CV effects associated with marijuana. Review of the available publications identifies that cardiovascular effects of marijuana are not always benign and may include serious hemodynamic changes, such as: tachycardia, hypotension, as well as clinically significant atrial and ventricular arrhythmias. Serious complications may result from these cardiovascular effects including: acute MI, tachycardia, syncope, dizziness significant arrhythmias, and death. Therefore, physicians, dispensaries, and prescribers need to understand the risks associated with recommending marijuana when no current recommendation standards exist. Patients need education regarding most the frequent marijuana effects (transient hypertension, tachycardia, possible syncope and dizziness and even myocardial injury with possible acceleration of atherosclerosis chronically). In our understanding, administration of medical marijuana should be regarded in the same manner as any new medication therapy with patient's requiring appropriate counseling prior to initiation.

## References

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