

Chronic marijuana consumption leading to reversible high-grade atrioventricular block in young male: A case report

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Abstract

Background Marijuana usage is increasing world over for both medicinal and recreational purposes. Several states are legalizing cannabis and physicians can expect to encounter more patients who use or abuse marijuana. Adverse cardiovascular effects of marijuana like myocardial infarction, cardiomyopathy and arrhythmias have been well described but bradyarrhythmia are rare and mechanisms are not well pronounced. Case summary A 26 years old young medical intern with history of chronic marijuana usage presented with complains of dizziness and recurrent syncope. Heart rate at presentation was 42 beats per minute and rest of the physical examination was unremarkable. There was high grade atrioventricular block in the Electrocardiogram (ECG) and subsequent electrophysiological (EP) study showed high grade supra-hisian (nodal)atrioventricular block with mildly prolonged his-ventricular (HV) interval. Urinary screen was positive for $\Delta 9$ -tetrahydrocannabinol (THC). After ruling out other possible causes, diagnosis of high-grade AV block due chronic marijuana use was made. Dual chamber pacemaker was implanted, and patient was discharged in stable condition. The heart rhythm completely improved at three-month follow-up. Discussion We report a novel finding in marijuana induced bradyarrhythmia. Reversible high grade atrioventricular (AV) block with electrophysiologic determination of site of conduction blockade is not reported previously. The mechanism of bradyarrhythmia is thought to be mediated by increased vagal tone. However direct toxic effects of $\Delta 9$ -tetrahydrocannabinol (THC), through cannabinoid receptors 1(CB1R) on the cardiac conduction system cannot be ruled out.

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Introduction

Cannabis is globally the most commonly used psychoactive substance and its use is increasing world over for both medicinal and recreational purposes. Physicians can expect to encounter more patients who use or abuse marijuana. Both acute and chronic adverse effects of cannabis on cardiovascular system like myocardial infarction, cardiomyopathy, tachyarrhythmias, stroke and cardiac arrest have been described and its consumption is a risk factor for cardiovascular disease in young adults.¹ The psychoactive constituent of marijuana, Δ 9-tetrahydrocannabinol (THC), is an agonist of both cannabinoid receptors 1 and 2 (CB1R and CB2R), and exerts its psychoactive and adverse cardiovascular effects through the activation of CB1R in the central nervous and cardiovascular systems. There are several proposed mechanisms for cannabis induced tachyarrhythmia but how it causes bradyarrhythmia is not very clear and mainly thought to be mediated by increased vagal tone.² Few cases of bradyarrhythmia have been described previously³⁻¹³ but reversible high grade atrio-ventricular (AV) block with electrophysiologic determination of site of conduction blockade is not reported to best of our knowledge. Our Patient presented with high grade AV block. The electrophysiological study revealed that the site of blockade was supra-his(nodal) and AV conduction completely improved at follow up, all of which support that cannabis induced bradyarrhythmia are vagally mediated.

Case presentation

A 26 years old young medical intern presented with complains of dizziness and recurrent syncope. At presentation his pulse was 42/min, blood pressure-100/70 mm of Hg, temperature-98.1F and respiratory rate 16/min. The rest of physical examination was within normal limits. Electrocardiogram (ECG) on presentation showed high grade atrioventricular block [Figure:1(a) and 1(b)]. There was no improvement in the heart rate by administration of intravenous atropine. Patient admitted to using marijuana since last 4 years and in preceding two years he was smoking 5-8 joints (4-5 grams) daily. Clinically possibility of congenital complete heart block (CHB) or CHB due to chronic use of Marijuana was kept in differential diagnosis.

His tonsillectomy was done 9 years back and at that time pre-anaesthetic check ECG was within normal limits. The routine medical check-up at the time of admission to medical collage was also normal, as per records. There was no family history of any heart disease.

The blood counts and metabolic panel were within normal limit (Supplementary table 1). Serological tests for syphilis, lymes disease, hepatitis B, hepatitis C and HIV were negative. Serial troponin-I reports did not show any elevation, patient's thyroid stimulating hormone was normal. Urinary screen 11-Nor-9-carboxy THC was positive (18ng/ml). The chest x-ray was normal. There was no evidence (clinical/ biochemical or radiological) to suggest rheumatic, sarcoid heart disease or myocarditis. On 2D-echocardiography cardiac chambers and valves were normal with normal left ventricular function (Ejection fraction=66%). On EP study the base line rhythm was 2:1 AV block with following parameters; AH interval -180ms, HV interval -85 ms, PP interval -648ms, RR interval -1274ms [Figure 2(a)]. High grade supra-his (nodal) AV block was observed while atrial pacing at 600ms cycle length [Figure 2(b)]. Coronary angiography was suggestive of normal coronaries.

Dual chamber pacemaker was implanted and patient was discharged in stable condition. At discharge ECG was showing ApVp (atrial paced ventricular paced) rhythm which changed to AsVp (atrial sensed ventricular paced) and then AsVs (atrial sensed ventricular sensed) rhythm over a period of 3 months.

Discussion

Cannabis consumption is mostly associated with chronic sinus tachycardia and other tachyarrhythmia like atrial fibrillation and ventricular tachycardia. A scoping study of 27 cases of arrhythmia associated with marijuana reported that most cases were young males and the mortality rate was high with Marijuana associated arrhythmia (11%). Atrial fibrillation (26%) and ventricular fibrillation (22%) were the most common arrhythmias. Brady arrhythmia were not common; first and second degree AV block and sinus arrest (3.7 % each) were the common findings among bradyarrhythmia group¹⁴ In another extensive review about the association of cannabis use and cardiac dysrhythmias, out of 42 subjects, third degree AV block was found in 12% of cases while symptomatic bradycardia was present in 10 % of the cases .¹⁵

Table 1 depicts reported cases of severe bradyarrhythmia due to marijuana toxicity. Till date about eleven cases of severe bradyarrhythmia are reported, out of which three cases were third degree heart block, two cases were second degree heart block and six cases were of sinus arrest. Pacemaker implantation was done in two cases of complete heart block and 3 cases of sinus arrest and in rest of the five cases conduction improved after abstinence from marijuana while one case was lost to follow-up. In none of the reported cases electrophysiological study was done to determine the site of blockade.

There are several proposed mechanisms for tachyarrhythmias caused due to cannabis like altered conduction property of myocardial tissue; cardiac ion channel modulation; autonomic dysfunction due to imbalance between sympathetic and parasympathetic outflow; type 2 myocardial infarction due to tachycardia, elevated carboxyhaemoglobin , slow coronary flow due to endothelial dysfunction, coronary vasospasm, increased platelet aggregation leading to ischaemic injuries/ scar creating a milieu for arrhythmia. However the exact mechanism by which it causes bradyarrhythmia is not well known .^{1,2} Agonistic action of THC on CB1R causes sympathetic inhibition and increased cardiac vagal tone leading to bradycardia, lower doses cause sympathetic stimulation while higher doses is associated with parasympathetic action. The electrophysiological effects of intravenous THC in human experimental studies on cardiac conduction includes a change in P wave morphology, decrease in sinoatrial (SA) conduction, delay in A-H (atrium to his bundle) interval and decrease in atrioventricular (A-V) node refractory period. However, In this case the HV interval was mildly prolonged , which is not explainable completely by previously described mechanisms and it is possible that Δ^9 -tetrahydrocannabinol (THC) has some direct toxic effects on cardiac conduction systems through cannabinoid receptors 1. Figure 3 demonstrates the possible mechanism of bradycardia caused by cannabis. Our Patient, who was young medical professional consumed marijuana for about 4 years and his previous medical record were not suggestive of any risk factor for complete heart block except chronic marijuana use. After initial evaluation he was implanted permanent pacemaker. During follow-up patient claimed complete abstinence from marijuana use. Patient atrio-ventricular conduction also improved in about 3 months duration.

Marijuana use is increasing world over for both medicinal and recreational purposes as states are legalizing cannabis and physicians can expect to encounter more patients who use or abuse marijuana .It can cause severe bradyarrhythmia, possibly mediated by enhanced vagal tone and might be reversible in case of withdrawal of usage. Awareness regarding such cardiovascular side effects of marijuana is warranted. Screening for marijuana use should be encouraged, especially in young patients presenting with cardiovascular disease.

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Figure Legends:

Figure 1(a): ECG at admission showing sinus bradycardia with intermittent loss of conduction of atrial impulse to ventricles and narrow escape QRS

Figure 1(b): ECG at admission showing atrioventricular dissociation with narrow escape QRS

Figure 2(a): Baseline Intracardiac tracing showing 2:1 AV block localized in AV node {Alternative atrial depolarization A is not followed by either a His bundle or ventricular depolarization (open arrow)}

Figure 2(b): Atrial pacing at 600 miliseconds cycle length showing high grade AV block at AV node

Figure 3: Central Illustration: The possible mechanism of bradyarrhythmia caused by cannabis



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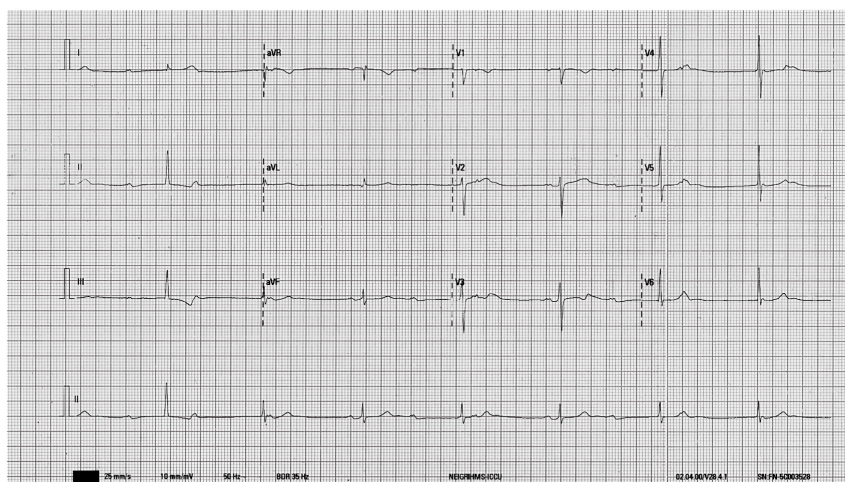


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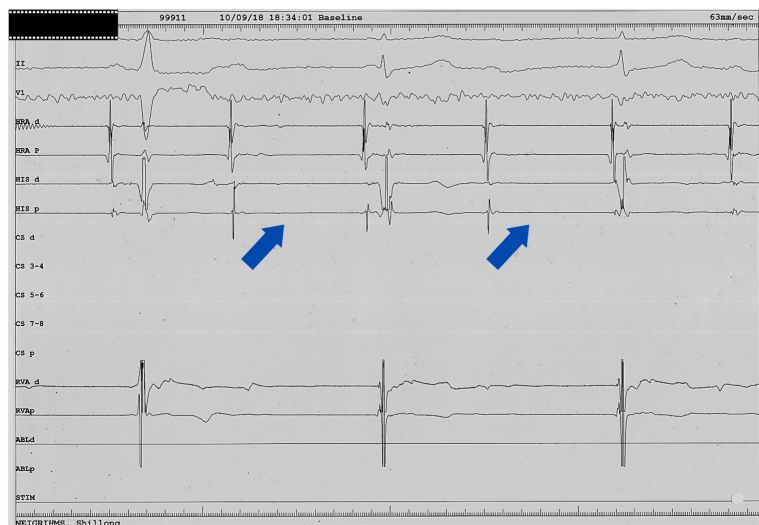


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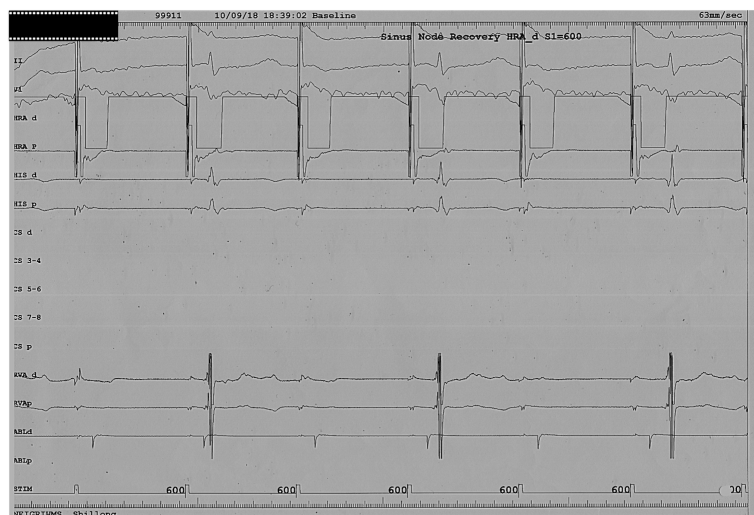


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