Association of recreational drug consumption, cardiac toxicity and heart transplantation

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Summary

Cardiac toxicity from recreational drug use remains difficult to establish. We report the cases of 3 young patients who were hospitalized for cardiogenic shock. All were bridged to transplantation with implantation of a left ventricular assist device (LVAD). They underwent uneventful heart transplantation. The patients did not have any significant personal or family medical history, but all admitted consuming large quantities of recreational drugs daily. Histological examination of the native heart did not show any inflammation or infiltrative myocardial disease. In this series of young patients presenting in cardiogenic shock with minimal histologic findings on examination of the native hearts, the association between cardiac toxicity and active use of recreational drugs remains a strong possibility. The transplant community should be made aware of this possible association in the current era of legalization and social trivialization of drug consumption.

Cardiac toxicity from recreational drugs such as cannabis, amphetamines and cocaine has been recognized in the past. Although secondary cardiac toxicity has been established, clinical cases of myocardial effect are not well described.[1–3] The present study suggests an association between active use of a combination of recreational drugs in young adults, the occurrence of acute cardiac failure necessitating mechanical support of diseased hearts and transplantation.

We reviewed our experience with 3 consecutive patients, respectively aged 19, 23 and 33 years, admitted at the Montreal Heart Institute with a presumed diagnosis of idiopathic dilated cardiomyopathy. They had no family history of congestive heart failure and no specific medical history of any significant disease in the past. All showed severe symptoms of congestive heart failure at hospital admission with cardiogenic shock. The condition of the youngest patient deteriorated rapidly despite intravenous milrinone and necessitated the implantation of extracorporeal membrane oxygenation (ECMO) to control evidence of cardiogenic shock and to allow peripheral perfusion. The other 2 patients remained on intravenous milrinone for several days, and the oldest one suffered from arrhythmic storm and repeated episodes of ventricular tachycardia (VT), necessitating multiple shocks from his implanted defibrillator and intravenous amiodarone. This patient was not deemed a candidate for VT ablation.

All 3 patients reported active consumption of a combination of recreational drugs, including cannabis, amphetamines and cocaine, in the recent past. They denied using cocaine in the few months before the present hospital admission. The 3 patients were evaluated by our psychiatric consultant and by a social worker and were judged to be acceptable candidates for transplantation with a good long-term prognosis in terms of abstinence of drugs despite positive testing for cannabis in their urine at the time of hospital admission. They all had strong family and social support, suggesting a good rehabilitation perspective.

Echocardiographic exams showed a significant decrease in left ventricular ejection fraction and an enlarged left ventricular cavity at the time of admission and of invasive intervention (Table 1).

Table 1. Transthoracic echocardiographic exams at hospital admission

Patient	LV diastolic diameter	LV ejection fraction	LV mass
1	71 mm	15%	155 g/m^2
2	68 mm	15%	—
3	55 mm	30%	79 g/m^2

LV = left ventricular.

All 3 patients underwent implantation of HeartMate left ventricular assist device (LVAD) support as a bridge to transplantation a few days after hospital admission and after implantation of the ECMO support in the youngest patient. The patient with repeated episodes of VT underwent cryosurgery ablation of the tachycardia as a concomitant surgical procedure with LVAD implantation. The 3 patients underwent successful heart transplantation after an average waiting time of a few months with their LVAD in place, with obvious total abstinence from the use of recreational drugs, confirmed by regular urine toxicity screenings.

Pathological analysis of the explanted hearts showed a normal histological aspect of the cardiomyocytes, minimal coronary atherosclerotic changes in 2 patients and evidence of subendocardic necrosis in the patient who underwent cryosurgical ablation of the VT. There was no evidence of inflammation or any specific change suggesting an acute myocarditis or an infiltrative myocardial disease. There was no evidence of amyloidosis or hemochromatosis at specific staining examination. There was no coronary occlusion or intraluminal thrombus formation. The short-term clinical course after heart transplantation was favourable, and no specific complications or recurrence of recreational drug usage were encountered at the time of this report.

Regular use of a combination of recreational drugs, such as cannabis, amphetamines and cocaine, was associated with acute cardiac decompensation, symptoms of congestive heart failure with cardiogenic shock and a presumed diagnosis of idiopathic cardiomyopathy in our small series of patients. The acute decompensation required implantation of mechanical support as a bridge to heart transplantation in all 3 patients. Interestingly, there was no histologic evidence of scar fibrosis, inflammation or infiltrative disease at microscopic evaluation of the native hearts.

Although the exact mechanism of cardiotoxicity remains elusive, an increased mitochondrial superoxide production has been suggested.[4] In a recent study, cocaine and ethanol, both together and independently, increased mitochondrial hyperpolarization and activation of common apoptosis pathways in cardiomyocytes.[5]

Although in 2015 the European Drug Emergencies Network reported that 35 patients presented with cardiac arrest at emergency departments during a 12-month study period,[1] cardiac arrest and decompensation remain a small fraction of the total volume of emergency admissions following the use of recreational drugs. Moreover, there are no data on the effect of a combination of recreational drugs and alcohol on the cardiac health status of users, but we can speculate that this would increase toxicity and adverse effects.

Conclusion

We suggest that an association between regular and active use of a combination of recreational drugs and acute cardiac decompensation with cardiogenic shock remains a strong possibility in the present series of patients. Raising awareness about the potential cardiac toxicity of these recreational drug combinations is of utmost importance. Indeed, with the current Canadian legislation allowing the legal procurement and usage of cannabis, we might expect an increase in the number of young patients with acute cardiac decompensation necessitating mechanical support of the failing heart and cardiac transplantation.

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References

1. Dines A, Wood DM, Galicia M, et al. Presentations to the emergency department following cannabis use—a multi-centre case series from ten European countries. *J Med Toxicol* 2015;11:415-21.
2. Orsini J, Blaak C, Rajayer S, et al. Prolonged cardiac arrest complicating a massive ST-segment elevation myocardial infarction associated with marijuana consumption. *J Community Hosp Intern Med Perspect* 2016;6:31695.
3. Neeki MM, Kulczycki M, Toy J, et al. Frequency of methamphetamine use as a major contributor toward the severity of cardiomyopathy in adults ≤50 years. *Am J Cardiol* 2016;118:585-9.
4. Varga ZV, Ferdinandy P, Liaudet L, et al. Drug-induced mitochondrial dysfunction and cardiotoxicity. *Am J Physiol Heart Circ Physiol* 2015;309:H1453-67.
5. Martins MJ, Roque Bravo R, Enea M, et al. Ethanol addictively enhances the in viro cardiotoxicity of cocaine through oxidative damage, energetic deregulation and apoptosis. *Arch Toxicol* 2018; 92:2311-25.