Recurrent Torsades de Pointes post Direct Current Cardioversion of Atrial Fibrillation

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Teaching Points

- Degeneration to torsades de pointes is a rare, but underappreciated risk of cardioversion.
- Overdrive pacing can be effective in preventing recurrent torsades de pointes.

Introduction

- Atrial fibrillation with rapid ventricular response (AF-RVR) results in the loss of atrial kick and shortened ventricular filling time, both of which often lead to decompensated heart failure.
- Pharmacologic rhythm control strategies are a popular treatment of choice and patients frequently benefit from restoration of sinus rhythm.
- When pharmacologic treatment is unsuccessful or a patient declines hemodynamically, direct current cardioversion is the treatment of choice.
- Torsades de pointes, or “twisting of the points" in French, is a rare, but under-appreciated risk of cardioversion therapy.

Case Report

- A 61 year old female with no significant past medical history presented to the emergency department with worsening dyspnea.
- BP: 139/91 Pulse: 139 Temp: 98.9F RR: 20 SpO2 100%RA
- Bun/Cr: 21/1.3 Na: 134 K: 4.7 Mg: 1.3 Lactate: 4.32 BNP: 11.9K Trop: 0.065
- Electrocardiogram (ECG) showed AF-RVR and chest x-ray was significant for bilateral pulmonary vascular congestion.
- Full dose anticoagulation and IV diuresis were initiated with moderate improvement in symptoms.
- Transthoracic echocardiogram revealed biventricular systolic dysfunction with a left ventricular ejection fraction of 30%.
- After consultation with electrophysiology, the consensus was to proceed with restoration of sinus rhythm in an attempt to improve the patient’s heart failure symptoms, and possibly her ejection fraction.
- Transesophageal echocardiogram was negative for the presence of a left atrial appendage thrombus.
- The patient was loaded with amiodarone and underwent successful direct current cardioversion with 200 Joules.
- That evening, the patient was noted to have frequent premature ventricular contractions (PVC) on telemetry monitoring with subsequent degeneration to torsades de pointes. CPR was initiated and the patient was cardioverted back to NSR with return of spontaneous circulation (ROSC).
- Post cardiac arrest ECG showed sinus bradycardia with a calculated QTc of 592. The patient arrested twice again the night and ROSC was achieved with cardioversion, intravenous magnesium, and lidocaine.

- An automatic implantable cardioverter-defibrillator (AICD) was subsequently implanted for secondary prevention of sudden cardiac death.
- The backup pacing rate of the AICD was set higher than usual in an attempt to prevent PVC induced torsades de pointes. After implantation of the AICD, the patient did not have any further ventricular arrhythmias and did not require any shocks.

Images

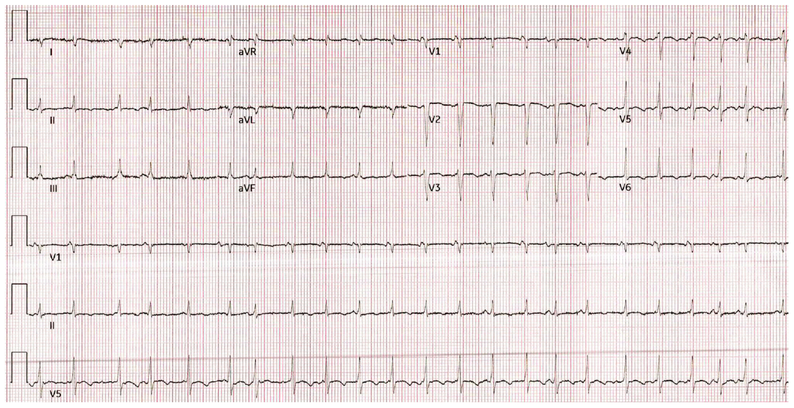

Fig 1: Admission 12 Lead EKG displaying A-Fib with RVR

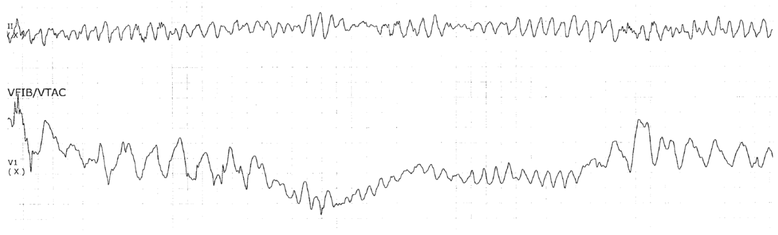

Fig 2: Degeneration into torsades de pointes shortly after direct current cardioversion

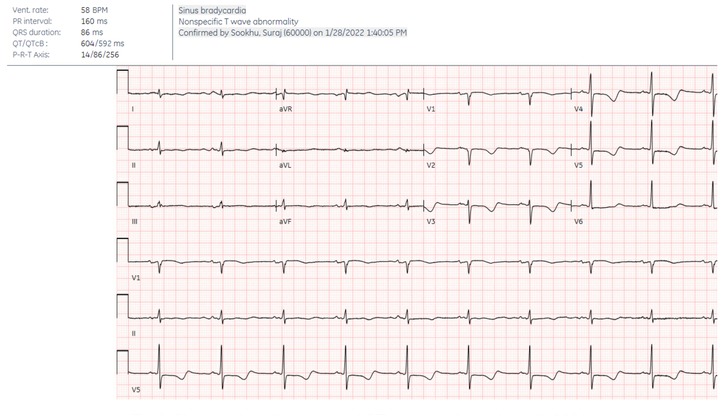

Fig 3: Sinus rhythm with prolonged QTc post cardioversion with 200J

Time Mark	1/30/22 01:54	1/29/22 20:54	1/29/22 07:36	1/29/22 05:48	1/29/22 02:45	1/28/22 10:45	1/28/22 10:37	1/28/22 10:34	1/28/22 08:45	1/28/22 03:50
GENERAL CHEMISTRY										
Glucose	129 ^	121 ^	127 ^	118 ^		121 ^			121 ^	101
Urea Nitrogen	22 ^	22 ^	20 ^	22 ^		21 ^			22 ^	20 ^
Creatinine	1.1 ^	1.1 ^	1.0	1.1 ^		1.1 ^			1.3 ^	1.0
Sodium	133 v	134 v	135 v	133 v		136 v			136 v	136 v
Potassium	3.6	3.9	4.0	3.6		4.7			3.9	3.4 v
Chloride	97 v	98	96 v	98		98			97 v	100
Carbon Dioxide	23	25	28	25		26			28	24
Calcium	9.7	10.0	9.8	9.8		10.2			10.0	10.1
Anion Gap	13.0	11.0	11.0	10.0		12.0			11.0	12.0
Phosphorus	4.7 ^	4.4			4.9 ^	4.1			4.2	
Total Protein	7.1		6.9	6.9		7.3			7.2	7.0
Albumin	3.9		3.7	3.8		4.2			4.1	4.0
Bilirubin,Total	0.8		0.9	0.8		1.4 ^			0.9	0.8
ALT(SGPT)	114 ^		108 ^	113 ^		136 ^			112 ^	114 ^
AST(SGOT)	99 ^		90 ^	98 ^		154 ^			107 ^	123 ^
Alkaline Phosphatase	95		70	75		92			77	82
Magnesium	1.8	2.1			1.6	2.0			1.8	1.6
Hemoglobin A1c										
ESTIMTED GLOMERUL...										
GFR MDRD Non Af Amer	50	50	56	50		50			42	56
GFR MDRD Af Amer	>60	>60	>60	>60		>60			50	>60
CARDIAC PROFILE										
Troponin I						0.047 ^				0.023
BNP					4,340 ^			5,050 ^		4,380 ^

Fig 4: Electrolyte during hospital stay

Discussion

Overdrive pacing is a method utilized to treat PVC induced torsades de pointes. PVC induced torsades de pointes occurs when a PVC occurs on the previous cardiac cardiac cycle’s t-wave. Pacing the patient's heart at a rate of 90 beats per minute prevented pause dependent PVCs, which in turn prevented PVC induced torsades de pointes. Overdrive pacing can control malignant ventricular arrhythmias without the need for traumatic cardiac defibrillation. In our patient, conversion of AF-RVR to NSR with prolonged QTc resulted in a slower heart rate and an increased the probability of a PVC occurring on the T wave and ensuing ventricular arrhythmia. This case highlights DCCV for AF-RVR resulting in persistent ventricular arrhythmia requiring ICD placement with overdrive pacing to prevent recurrence.

References

1) Magdi M, Mubasher M, Alzaeem H, Hamid T. Resistant Ventricular Arrhythmia and the Role of Overdrive Pacing in the Suppression of the Electrical Storm. Case Rep Cardiol. 2019 May 22;2019:6592927. doi: 10.1155/2019/6592927. PMID: 31249712; PMCID: PMC6556359.
2) Cohagan B, Brandis D. Torsade de Pointes. [Updated 2021 Aug 11]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459388/