

Profound Hypotension in Supraventricular Tachycardia with Intermittent Wolff-Parkinson-White Syndrome Refractory to Cardioversion

Dennis Miraglia^{1,*}, Orlando Marini²

¹Department of Internal Medicine, Good Samaritan Hospital, Aguadilla, PR

²Division of Cardiovascular Disease, Department of Internal Medicine, Good Samaritan Hospital, Aguadilla, PR

*Corresponding author: dennismiraglia@hotmail.com

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Abstract We report a case of an 87-year-old man with unstable supraventricular tachycardia (SVT) with intermittent Wolff-Parkinson-White (WPW) syndrome refractory to biphasic synchronized electrical cardioversion terminated by adding intravenous amiodarone. We conclude that the unique properties of intravenous amiodarone might make it especially effective in emergency situations when urgent intervention is needed to terminate life-threatening wide-complex tachycardias (WCTs) with evidence of hemodynamic instability refractory to synchronized electrical cardioversion.

Keywords: *supraventricular tachycardia (SVT), Wolff-Parkinson-White (WPW) syndrome, amiodarone, synchronized electrical cardioversion*

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1. Introduction

The accurate diagnosis of wide complex tachycardias (WCTs) in emergency situations can be challenging and of clinical significance as those rhythms can be deleterious if they become refractory to standard management. In addition, a significant proportion of WCTs remain undiagnosed even by experts, as occasionally they turn out to be unclear despite all available criteria. When confronted with these scenarios, the clinician should treat undetermined WCTs as if they are ventricular tachycardia (VT). Synchronized electrical cardioversion becomes the preferred treatment for such events when evidence of hemodynamic instability is present. It is especially important to determine whether the rhythm is irregular since it limits your differential diagnosis to atrial fibrillation (AFib) with aberrant conduction, including RBBB and LBBB, AFib with pre-excitation syndrome (usually WPW pattern), and polymorphic VT [1,2,3]. We discuss the case of an 87-year-old man who presented with unstable vital signs and a sustained wide QRS complex tachycardia refractory to synchronized electrical cardioversion which was subsequently diagnosed as AFib with WPS syndrome (Figure 1). We have reported the case because AFib with WPS syndrome refractory to synchronized electrical cardioversion is uncommon and

people who develop this arrhythmia have the potential to precipitated into life-threatening dysrhythmias and sudden cardiac death. Furthermore, this case illustrates the diagnostic and therapeutic dilemmas in patients with wide QRS tachycardia and undiagnosed AFib with WPW syndrome.

2. Case Presentation

An 87-year-old man with a past medical history of cholesterolemia, hypertension, coronary artery disease (CAD), hypothyroidism, and Alzheimer's disease was brought to the emergency department by ambulance with a chief complaint of vomiting for a week, associated with abdominal pain, and chest discomfort. He was alert and conscious upon arrival and his abdomen was mildly distended with epigastric tenderness. Vital signs included a temperature of 36.5°C, a pulse rate of 92 beats/min, a respiratory rate of 20 breaths/min, oxygen saturation of 97-100% on pulse oximetry, and blood pressure of 139/88 mmHg with a mean arterial pressure (MAP) of 105 mmHg. His initial labs showed a hemoglobin of 16.1 g/dL. The metabolic panel revealed a sodium 141 mEq/L, potassium 4.6 mEq/L, blood urea nitrogen (BUN) 23 mg/dL, creatinine 0.9 mg/dL and cardiac troponin T (cTnT) 0.010 ng/mL among other normal values.

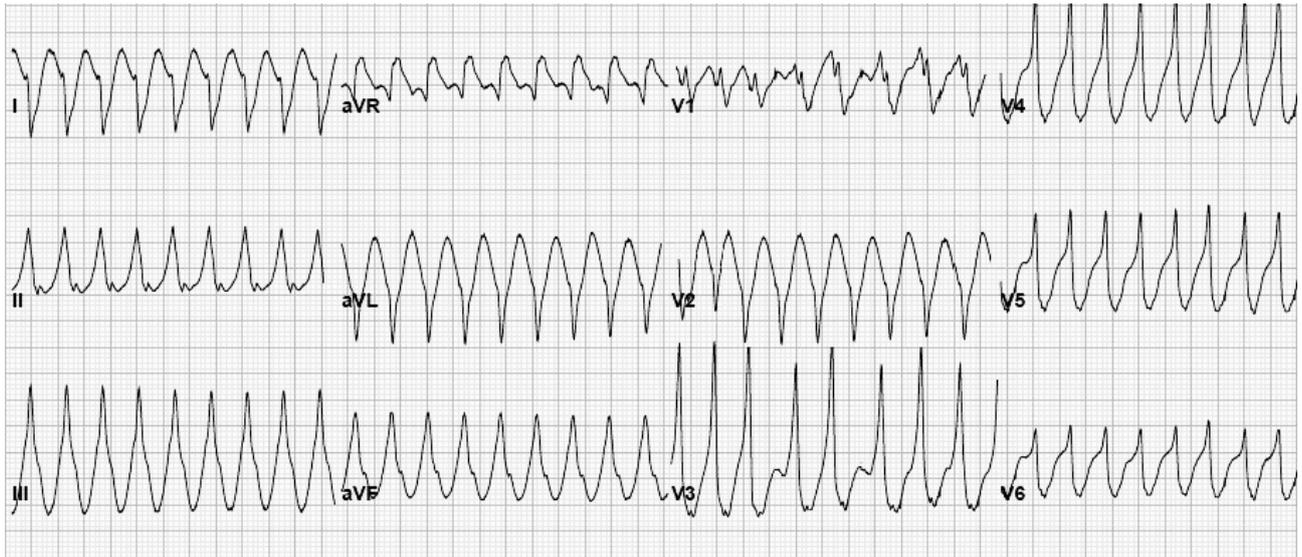


Figure 1. EKG shortly after arrival to the ICU. Atrial fibrillation with WPS syndrome resulting in a rapid, irregularly irregular wide-complex tachycardia with varying QRS width

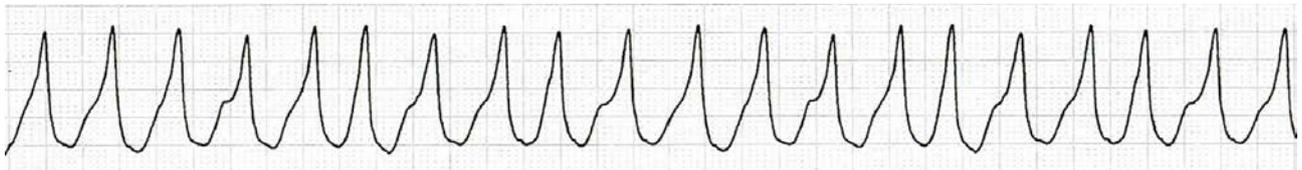


Figure 2A. EKG shortly after arrival to the ICU. Irregularly irregular wide-complex tachycardia with intermittent WPW syndrome with a rate of 170 beats/min

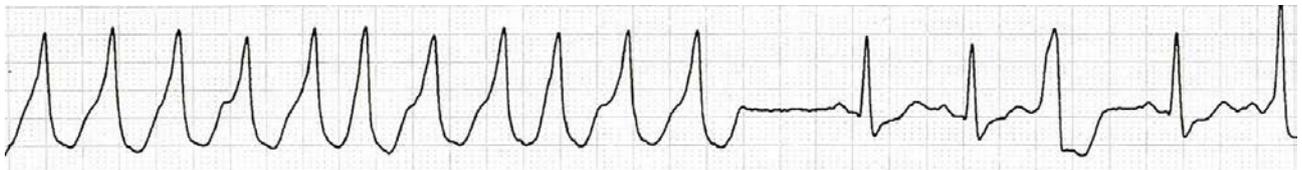


Figure 2B. EKG six minutes after administration of IV amiodarone by slow injection (1 mg/min). Irregularly irregular wide-complex tachycardia with intermittent WPW syndrome followed by sinus rhythm with a rate of 95-100 beats/min

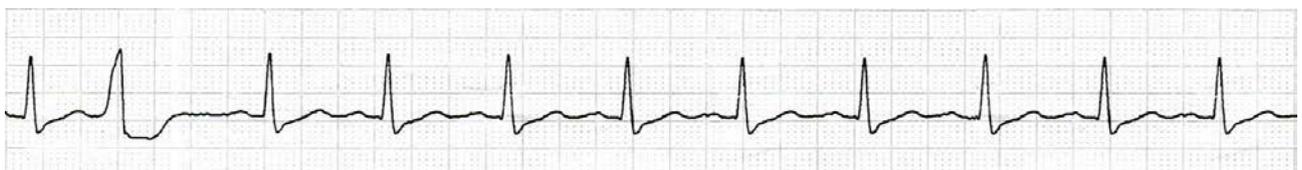


Figure 2C. EKG while on IV amiodarone maintenance infusion (0.5 mg/min). Normal sinus rhythm with a premature ventricular contraction (PVCs) with a rate of 90-100 beats/min

His chest x-ray (CXR) revealed ill-defined non-specific densities more prominent in the left middle zone and an atheromatous and tortuous thoracic aorta characteristic of chronic atherosclerotic disease. The initial 12-lead electrocardiogram (EKG) obtained at the emergency department revealed a normal sinus rhythm at 95 beats/min with episodes of short PR with delta waves suggesting intermittent WPW pattern, normal QRS, slight QT prolongation (QTc, 476 ms), nonspecific ST-T-wave changes, unifocal PACs, unifocal PVCs arising from the right ventricle, idioventricular conduction delay and left ventricular hypertrophy. An abdominal CT obtained at the emergency department showed gastric outlet obstruction, a diagnosis that led to the admission of the patient. The obstruction was later confirmed by endoscopy which

revealed an ulcerated lesion at the region of the pylorus and proximal duodenal bulb. A surgical consultation was requested, and the pre-operative work-up initiated. As the patient was at higher risk of intraoperative complications and less likely to meet the increased oxygen demand during surgery because of his many cardiac risk factors, such as advanced age, male gender, cholesterolemia, coronary artery disease, and chronic hypertension, a transthoracic echocardiogram (TTE) was obtained to assess his heart's function. The bedside TTE revealed the left ventricle (LV) to be mildly dilated with severely decreased systolic function and global left ventricular hypokinesis without regional heterogeneity with an ejection fraction (EF) of 20%. There was no evaluation performed to delineate the etiology of severe left

ventricular dysfunction (LVD) prior to surgery. In an attempt to optimize his cardiovascular function and maintain adequate tissue perfusion for the proposed surgical procedure, the patient received a combination of fluids and an intravenous (IV) infusion of dobutamine 500 mg in 250 mL of D5W that was started at 6 mcg/kg/min. Studies have shown decreased morbidity and mortality when fluids and dobutamine are combined to maximize oxygen transport in high risk elderly surgical patients. [4] Fully aware of the risks imposed by his cardiac condition, the family members agreed to surgery and informed consent was obtained. The patient was taken to the operating room. He developed an intraoperative episode of paroxysmal (intermittent) supraventricular tachycardia (SVT) with intermittent WPW syndrome and hemodynamic instability. The procedure was completed, and the patient was emergently transferred to the intensive care unit (ICU) post antrectomy and gastrojejunostomy with profound hypotension. On arrival to the ICU, his vital signs included a temperature of 36°C, a respiratory rate of 16 breaths/min with an oxygen saturation of 96% on pulse oximetry and a fraction of inspired oxygen (FiO₂) of 45% on assist-control mechanical ventilation. The telemetry monitor showed a normal sinus rhythm with a pulse rate of 85 beats/min, a blood pressure of 46/38 mmHg, and a MAP of 41 mmHg. A rapid administration of fluid challenge of 1000 cc crystalloid solution was started immediately without significant change in blood pressure. Dopamine 800 mg in 250 mL of D5W was started at 25 mcg/kg/min and the patient's blood pressure increased to 82/55 mmHg with a MAP of 64 mmHg. [5,6] Few minutes after the patient arrived at the unit, he developed a persistent unstable SVT with intermittent WPW syndrome refractory to synchronized electrical cardioversion. [7] Without any delay, four 200 J biphasic QRS-synchronized shocks were delivered followed by midazolam 10 mg IV push and subsequently six shocks at 360 J that failed to terminate the arrhythmia. At first glance, it was challenging to evaluate the irregularity of the rhythm because of the rapid heart rate, but when analyzed carefully, the rhythm was deemed irregular. (Figure 2A) Simultaneously to the second synchronized electrical cardioversion attempt at 200 J, an IV loading dose of amiodarone 150 mg was administered over 10 minutes, but this failed to terminate the arrhythmia as well. The amiodarone loading dose was followed by slow infusion 360 mg over the next 6 hours at 1mg/min. The response to the infusion was rapidly seen as the heart rate dropped to 95-100 beats/min after a few minutes (Figure 2B), promptly restoring to normal sinus rhythm after 16 minutes of initiation of IV therapy (Figure 2C). Amiodarone remained as a continuous maintenance infusion over the remaining 18 hours at 0.5 mg/min. After the first 24 hours, amiodarone was continued as an IV maintenance infusion over the next 3 days at 0.5 mg/min. [8,9,10,11] The etiologies of hypotension in this patient are probably multifactorial, but the initial treatment was independent of the etiology. An hour later after the termination of the arrhythmia the patient remained hypotensive despite the fluid challenge and the dopamine drip. Subsequently, a norepinephrine drip 8 mg in 250 mL of D5W was started at 0.2 mcg/kg/min in order to maintain a systolic blood pressure of at least 90-100

mmHg and a MAP \geq 65 mmHg. The patient was subsequently referred to the cardiology department for treatment and follow up for electrophysiology studies and to prevent recurrent life-threatening dysrhythmias. It is worth noting that blood work obtained after the management of the arrhythmia showed a potassium level of 3.98 mmol/l and a magnesium level of 2.1 mg/dl. Cardiac troponin T (cTnT) remained normal. In contrast, the result of the arterial blood gas (ABG) analysis revealed: a pH of 7.28, paCO₂ 49.0, and HCO₃⁻ 21.3. Cerebral Performance Category (CPC) was consistent with the score of 2 at 24 hours, 1 week and no significant change was found at 2 weeks. A few days later relevant issues concerning resuscitation had been discussed in great details with his family due to the patient's critical condition and, in accordance with the next of kind's preference, a DNR order was established. The patient died on postoperative day 22 from postoperative refractory hypotension and multiple organ failure (MOF).

3. Discussion

The American Heart Association's advanced cardiac life support (ACLS) guidelines recommend synchronized electrical cardioversion for WCTs with hemodynamic instability. Although most arrhythmias respond to the administration of synchronized electrical cardioversion at 200 J, a small percentage of patients do not. This case highlights a different approach to terminate the arrhythmia when the standard treatment fails. Adding an IV antiarrhythmic such as amiodarone as adjuvant therapy with synchronized electrical cardioversion may be used for management of undetermined WCTs with hemodynamic instability refractory to synchronized cardioversion. The correct diagnosis of wide complex tachycardia is important not only because it is a complex differential diagnosis, but also for the acute arrhythmia management. First, this case presents a common scenario where recognizing irregularity in WCT is of great significance since it limits your differential diagnosis to AFib with aberrant conduction, including RBBB and LBBB, AFib with pre-excitation syndrome (usually WPW pattern), and polymorphic VT. Nevertheless, in a small percentage of WCTs, the diagnosis occasionally turns out to be unclear. When uncertainty or undetermined WCTs is present with evidence of hemodynamic instability, the best decision is to immediately perform synchronized electrical cardioversion and treat as if they are VT. [1,2,3] In hemodynamically stable patients, procainamide would have been the preferred drug for the conversion of WPW syndrome; however, amiodarone was used because the patient was treated as having an undetermined WCT with evidence of hemodynamic instability. When it comes to electrical cardioversion, we could attempt biphasic synchronized electrical cardioversion through defibrillators that offer a full range of energy with default escalating settings of 200 J 300 J, and 360 J, or we could attempt simultaneous synchronized electrical cardioversion using energy selection of 200 J from two defibrillators for a total of 400 J as these approaches can successfully restore the arrhythmia to sinus rhythm. Specific recommendations for the latter approach do not exist and to our knowledge have

not been investigated in a retrospective or prospective observational hospital-based study; however, double external direct-current (DC) cardioversion and double sequential defibrillation (DSD) have demonstrated to be an effective and safe method to treat refractory AFib and refractory ventricular fibrillation (VF) in the out-of-hospital cardiac arrest (OHCA) as described in a few case reports and case series. [12-18]

4. Conclusion

We conclude that the unique properties of IV amiodarone on influencing bypass tract, as well as the atrioventricular (AV) node, might make it especially effective in emergency situations when urgent pharmacological cardioversion is needed to terminate undiagnosed wide QRS complex tachycardias refractory to synchronized electrical cardioversion, thus keeping in mind underlying AFib with the pre-excitation syndrome (usually WPW pattern) as a possible differential diagnosis to avoid potentially catastrophic events.

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Conflict of Interests

The authors have no conflict of interests.

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Abbreviations

LBBB, left bundle branch block; PACs, premature atrial contractions; PVCs, premature ventricular contractions; RBBB, right bundle branch block.

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