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Case Report: Double Sequential Synchronized Cardioversion for Refractory Arrhythmia

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Abstract

Wide Complex Tachycardia (WCT) can potentially be a life-threatening condition that poses significant challenges in managing. Here we present a case of a 57-year-old Itaukei male who presented with wide complex tachycardia. Despite the use of pharmacological treatment, the tachycardia persisted. Multiple attempts at synchronized cardioversions in different configurations failed to cardiovert the patient. This refractory arrhythmia was then terminated using a Double Sequential Synchronized Cardioversion (DSSC). This case highlights the indication and appropriate technique for DSSC in managing refractory arrhythmia. We reviewed the literature regarding appropriate use of DSSC.

Keywords: Wide Complex Tachycardia (WCT), Double Sequential Synchronized Cardioversion (DSSC), Pre-Excited Atrial Fibrillation (Pre-Excited AF), Ventricular Tachycardia (VT)

Introduction

Wide complex tachycardia is generally presumed to be Ventricular Tachycardia (VT) and is frequently associated with hemodynamic instability. Hence, expeditious termination of tachycardia using pharmacological or non-pharmacological means is critical and lifesaving. In patients who develop hemodynamic instability, synchronized electrical cardioversion is recommended by ACC/AHA/HRS guidelines [1]. While synchronized cardioversion succeeds in overwhelming majority of cases in terminating the tachyarrhythmias, there are situations where it fails, and these situations presents a challenge for the medical team.

Synchronized cardioversion involves the delivering of energy timed in conjunction with QRS complex to avoid the possibility of depolarization during vulnerable period thereby preventing ventricular fibrillation. This is possible during organized ventricular electrical activity such as ventricular tachycardia, supraventricular tachycardia as well as atrial fibrillation. However, under rare circumstances it does not succeed in defibrillating the patient out of arrhythmia [2]. In such cases, Double Sequential Synchronized Cardioversion (DSSC) has been recommended. This is an alternative technique which may increase the likelihood of terminating the arrhythmia by depolarizing the complete myocardium, but the exact mechanism is unknown.

This case report describes the successful use of DSSC in a hemodynamically unstable patient with refractory wide complex tachycardia at our institute, after multiple failed attempts at synchronized cardioversion, thereby emphasizing its role in emergency settings.

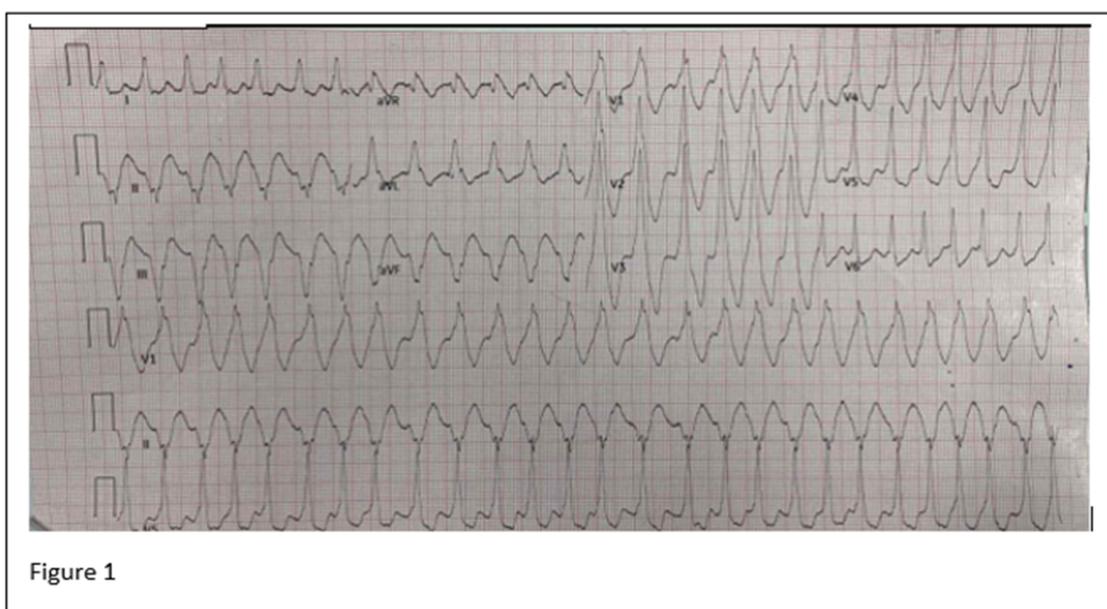
Case Presentation

Patient Information

A 57-year-old iTaukei male presented to our emergency department with palpitations that began while driving. The patient did not experience headache, syncope, diaphoresis, fever, chest pain or shortness of breath. He had previous instances of tachyarrhythmias which was chemically and electrically cardioverted and had been prescribed Aspirin 100mg PO OD, Metoprolol 25mg PO BD, Atorvastatin 40mg PO nightly and amiodarone 200mg PO OD. The patient was compliant with his medication. Prior to presenting to the emergency department, the patient had attempted Valsalva maneuver without success.

On presentations, the patient's vital signs showed blood pressure of 111/85 mmHg, heart rate 141 bpm, oxygen saturation, 99% on room air, afebrile. On examination, he was found to be alert and awake, with no respiratory distress. Lung fields were clear with a soft and non-tender abdomen. Extremities were well-perfused extremities with good volume pulses. Complete blood count and blood chemistry was normal.

Initial ECG demonstrated irregular, wide QRS with positive concordance in the precordial leads (Figure 1). The patient was loaded with IV Amiodarone 300mg (as this was the available medication at site) in the bolus form administered over 10 minutes while being attached to defibrillation pads. Magnesium sulfate was also administered in an attempt to chemically cardiovert the patient.



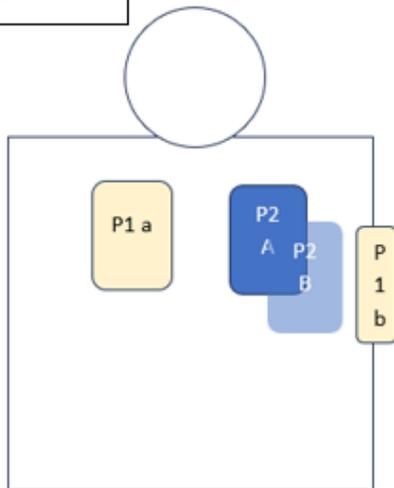
The patient's blood pressure continued to drop 92/62, 80/55 and 88/52 after these pharmacological interventions and normal saline 0.9% administration prompting further emergent intervention. Synchronized cardioversion was attempted using Mindray BeneHeart D3 biphasic defibrillator at escalating energies (50J, 100J, 150J, 200J) under sedation without success. Vector change with pads transferred from the standard anterior-lateral to the anterior-posterior position trialed for cardioversion but was unsuccessful.

Cardiologist was consulted due to refractory arrhythmia. At this point in time, the EKGs were further reviewed by cardiology team. It was recognized that the wide complex tachycardia was irregular and the EKG was most consistent with atrial fibrillation with conduction over accessory pathway. Hence, immediate plans for cardioversion were performed. Considering the failure of synchronized cardioversion, it was decided to attempt DSSC under procedural sedation.

Preparation

Two Mindray Beneheart D3 biphasic defibrillators (Photograph 2) were used with four pads placed: the first set at the right upper chest and left lower lateral chest wall, and the second set at the left upper chest and left posterior chest. (Figure 2 and photograph 1) Preparation for airway support was available at the bedside. Below is an example of how we placed the two sets of defibrillation pads that was similar to Sheikh H et al. (2018) [3].

Figure 2



Pad (P) 1a: Place on the right upper chest, inferior of right clavicle at right mid clavicular line.

Pad (P) 1b: Placed left lateral chest wall along the mid-axillary line (corresponding to the V5-6 area).

Pad (P) 2A: Placed below the left clavicle at left mid clavicular line

Pad (P) 2B: Placed posteriorly, to the left posterior chest at the scapula region



Photograph 1



Photograph 2

Morphine 2.5mg IV and Midazolam 5mg IV were administered. Supportive O₂ via rebreather was given.

Procedure

Synchronized shocks at 200J were delivered simultaneously from both defibrillators with a single person pressing the button to deliver energy presumably <1sec (total 400J).

First Cardioversion

Transient normal sinus rhythm (NSR) followed by WCT at 160 bpm. Since now it was recognized to be atrial fibrillation with conduction over accessory pathway, any further use of amiodarone or other AV nodal agent was avoided and it was decided to perform cardioversion.

Within 10 minutes a Second Cardioversion was performed with successful conversion to normal sinus rhythm at 60 bpm (Figure 3). ECG was obtained which showed negative delta wave in the inferior leads, likely right poster septal pathway. In retrospect, the QRS complex matches with delta wave and hence the diagnosis of wide complex tachycardia as pre-excited AF was confirmed.

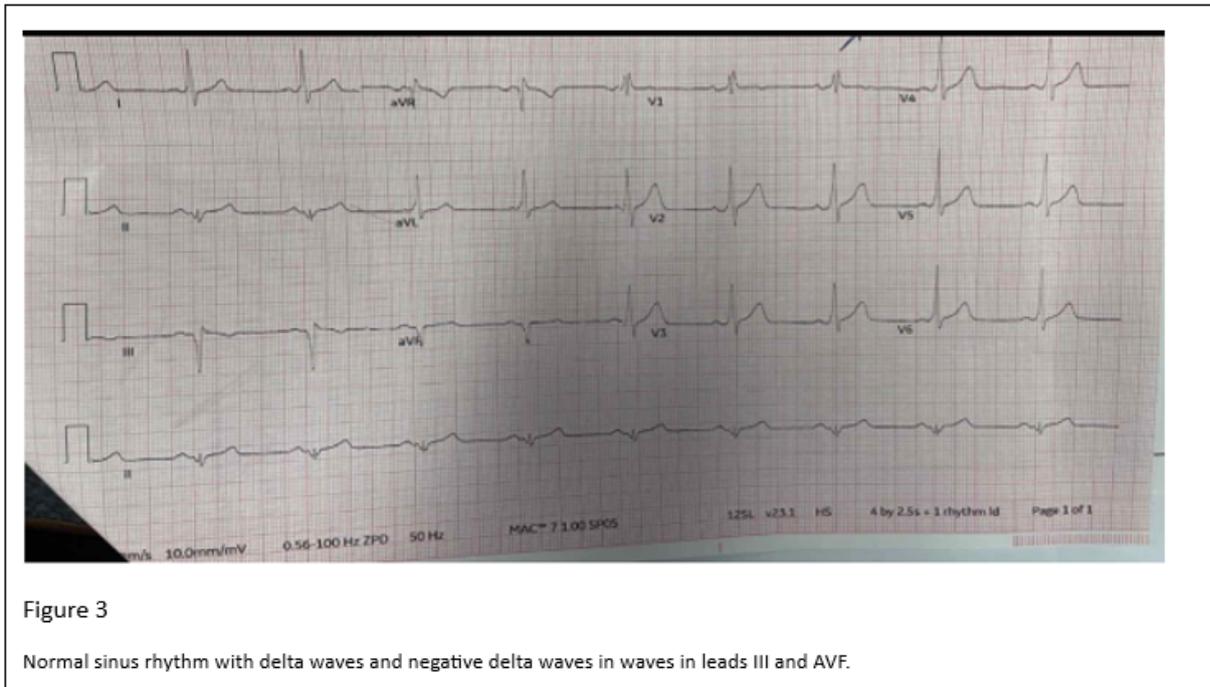


Figure 3

Normal sinus rhythm with delta waves and negative delta waves in waves in leads III and AVF.

After 30mins of cardiac monitoring the patient was alert and aware. He was hemodynamically stable. He had a repeat troponin of 24ng/L post cardioversion, cholesterol panel and thyroid function test was normal. A chest Xray showed the heart was slightly enlarged with a cardiothoracic ratio (CTR) 17/31. His inpatient echocardiogram showed a normal ejection fraction of 55% with no regional wall motion abnormalities and no valvular abnormalities. He was discharged with Flecainide 100mg twice a day along with Metoprolol 50mg twice a day. Amiodarone was discontinued. He was scheduled for electrophysiology study (EPS) +/- ablation at tertiary care center.

Discussion

The cornerstone of acute management for wide complex tachycardia is to stabilize the patient hemodynamically. In our patient, who was previously on oral Amiodarone, the rhythm was initially managed as Ventricular Tachycardia (VT), leading to the administration of Amiodarone and multiple attempts at electrical cardioversion with pads in various configurations. All AV nodal blocking agents, including Amiodarone, were promptly stopped once the correct diagnosis of pre-excited Atrial Fibrillation (AF) was recognized.

Our patient, while not presenting with VT, exhibited pre-excited AF manifesting as wide complex tachycardia and later progressed to hemodynamic instability, necessitating cardioversion. The failure of standard cardioversion can be attributed to factors such as high transthoracic impedance, unusual cardiac anatomy, or suboptimal pad position. Double sequential synchronized cardioversion (DSSC) is hypothesized to overcome these barriers by simultaneously depolarizing a larger critical mass of the myocardium from two different current vectors.

Rodríguez EV et al reports that the double sequential transthoracic shock was highly effective, successfully restoring sinus rhythm in 90.4% (19 out of 21) of patients who were refractory to standard therapy using high-energy monophasic transthoracic shocks (total 720J) despite differences in pad placement but the combined energy and the multi-vector approach can "capture" more of the heart muscle and break the chaotic electrical circuits of atrial fibrillation that a single shock could not [5].

Previous case reports have reported similar successful use of DSSC for treatment of refractory hemodynamically unstable ventricular tachycardia after multiple cardioversions failed. Sheikh H et al report a case of a patient with monomorphic VT on arrival with multiple attempts at electrical cardioversion and escalated to a successful double sequential 200J synchronized shocks [3]. Kamil et al report had a patient who was unstable and received multiple synchronized cardioversions with amiodarone administered after the third shock [4]. DSSC was eventually used to successfully cardiovert this patient.

A critical distinction must be made in the application of this tool. The published DOSE VF trial on Double Sequential External Defibrillation (DSED) for refractory pulseless ventricular fibrillation underscores a fundamental principle: the same tool must be applied with different intentions based on the clinical context [6]. For the pulseless patient in refractory VF, DSED is an unsynchronized, high-energy rescue shock to terminate a lethal rhythm. In contrast, for our unstable patient with a refractory arrhythmia with a pulse, the goal is a synchronized, high-energy shock to restore sinus rhythm without inducing VF. Technically, this requires perfect coordination to ensure both defibrillators deliver their shocks simultaneously, typically with a single operator commanding the charge and a second operator pressing both shock buttons at once.

We were able to successfully cardiovert the patient using DSSC. Our case presents a rare situation of refractory arrhythmia, which is to recognize and needs an alternative treatment.

Conclusion

This case demonstrates that Double Sequential Synchronized Cardioversion (DSSC) is a viable and potentially lifesaving intervention for a spectrum of refractory arrhythmias, extending beyond ventricular tachycardia to include pre-excited atrial fibrillation. Its successful application here provides a crucial blueprint for managing similar unstable patients when standard measures fail. Equally important is this case's critical reminder to avoid AV nodal blocking agents like amiodarone in pre-excited AF, adhering instead to guideline-directed therapy with procainamide or ibutilide for stable patients. As this technique gains traction, the need to research more and training to ensure clinicians are prepared to execute it effectively, turning a last-resort effort into a definitive, life-saving procedure.

Abbreviations

Wide Complex Tachycardia (WCT), Ventricular Tachycardia (VT) Double Sequential Synchronized Cardioversion (DSSC), Atrial Fibrillation (AF), Cardio Thoracic Ratio (CTR), Electro Physiology Study (EPS), ECG (Electrocardiogram)

Contributions

All authors were actively involved in the clinical management of the patient and contributed to the development of this case report. K.G.G.M. drafted the initial manuscript and led subsequent revisions. G.T. provided critical evaluation of the first draft, offering constructive feedback and recommendations on proper citation practices. All authors participated in the critical review, revision, and final approval of the manuscript. B.K.B. supervised the final manuscript preparation and coordinated with the acknowledged individual for editorial support.

Consent to Publish declaration

The patient gave us informed and signed consent for his photographs, images, and medical information for publication.

Ethics Declarations

Ethical Approval

This case report does not contain data pertaining to any studies with human participants or animals, performed by any of the authors. Approved by Fiji Human Health Research and Ethics Review Committee and Lautoka Hospital for this case publication.

Conflict of Interests

Authors declare no conflict of interest.

Funding Declaration

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References

1. Al-Khatib, S. M., Stevenson, W. G., Ackerman, M. J., Bryant, W. J., Callans, D. J., Curtis, A. B., ... & Page, R. L. (2018). 2017 AHA/ACC/HRS guideline for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *Journal of the American College of Cardiology*, 72(14), e91-e220.
2. American Heart Association. Synchronization to prevent this complication is recommended for hemodynamically stable wide-complex tachycardia requiring cardioversion, supraventricular tachycardia, atrial fibrillation, and atrial flutter [Internet]. *Circulation*. 2000;102(Suppl 1):I-90.
3. Sheikh, H., Xie, E., & Austin, E. (2018). Double sequential cardioversion for refractory ventricular tachycardia: A case report. *Canadian Journal of Emergency Medicine*, 20(S2), S56-S60.
4. Kamil, M. K. M., Othman, N. N., Aziz, M. A., & Ismail, S. A. (2023). Double Sequential Synchronised Cardioversion for Refractory Unstable Ventricular Tachycardia.
5. Rodríguez, E. V., Enríquez, A. M., Rodríguez, C. C., Morales, G. O., Rojo, J. R., & Estrada, S. A. (2005). Double sequential electrical transthoracic shocks for refractory atrial fibrillation. *Archivos de cardiología de México*, 75(S3), 69-80.
6. Cheskes, S., Verbeek, P. R., Drennan, I. R., McLeod, S. L., Turner, L., Pinto, R., ... & Scales, D. C. (2022). Defibrillation strategies for refractory ventricular fibrillation. *New England Journal of Medicine*, 387(21), 1947-1956.