Case Report

A racing heart beat: To shock or not

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Abstract

Ventricular tachycardia (VT), which most commonly occurs in patients with structural heart disease, can be associated with an increased risk of sudden death [1]. The most common cause of ventricular fibrillation is acute coronary ischemia, whereas a myocardial scar from prior infarct is the most common cause of sustained monomorphic VT in patients with structural heart disease. More benign forms of idiopathic VT can also occur in the absence of structural heart disease. Treatment of VT involves both emergent management and prevention of recurrence with medical and device therapy. The left ventricular ejection fraction is most frequently used to stratify patients who are at risk of sudden death. This article the importance of recognizing a sustained pulsed VT, and preventing it from progressing into a cardiac arrest with appropriate treatment involving synchronized cardioversion, thereby reducing the chances of cardiac arrest.

Keywords: Ventricular tachycardia; unstable tachyarrhythmia; synchronized cardio-version; anticoagulants; ECG; defibrillator; inotropes.

1. Case presentation

A 70-years gentleman came to the emergency with a history of sudden onset of giddiness and palpitations for 1 day, and complaints of worsening shortness of breath for 1 h, associated with nausea and one episode of vomiting in the ED. Prior to onset of dyspnoea, there was a history of straining to pass stools as he had been constipated for the last 4 days

Patient was a known case of Diabetic, CAD - S/P CABG in Feb 2021 with severe LV dysfunction EF 35%.

On arrival, he was conscious, tachycardic with HR of 180 min^{-1}, hypoxic with SpO_2 88% RA, tachypnea 30 min^{-1}, with increased work of breathing involving excessive usage of accessory respiratory muscles indicating extreme respiratory distress, with cold peripheries and BP not recordable.

So instantly, we connected the high flow oxygen mask with non-re-breathing mask at 15 L min^{-1} flow rate, connected the cardiac monitors, and there flashed the monitor rhythm showing a ventricular tachycardia with palpable pulse. His 12 lead ECG confirmed a regular, wide complex tachycardia which helped us arrive at the diagnosis of Unstable tachyarrhythmia - Ventricular Tachycardia (VT) with pulse.

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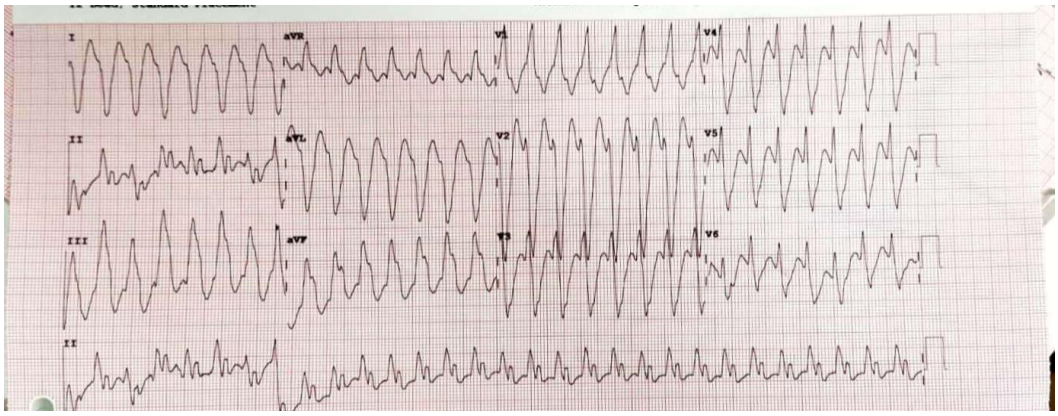
1.1. Initial 12 lead ECG



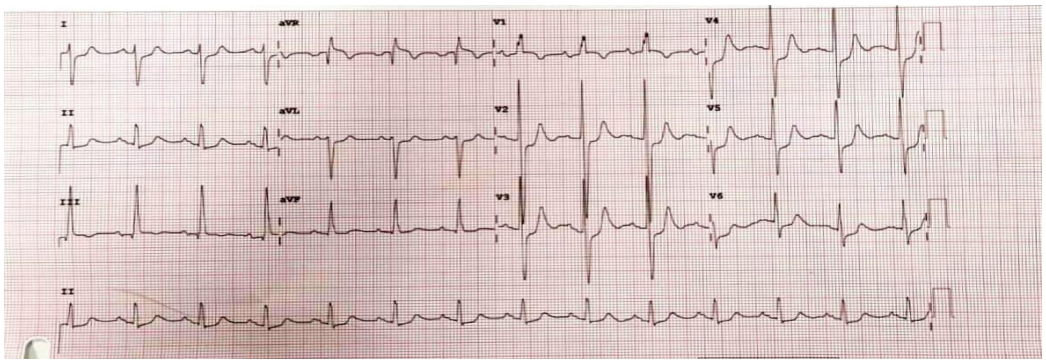
We instantly connected the defibrillator too, knowing he is going to require it soon. We also secured a wide bore cannula which was difficult, so without wasting more time, we straight away got a right EJV cannulation done.

After discussing with attenders, the need of synchronized cardio version in order to stabilize this patient, informed consent obtained.

After keeping an airway trolley besides, with all precautions in place. Drugs given for procedural sedation included: Inj. Fentanyl 25 mcg IV stat and Inj. heparin 5000 U IV stat was given prophylactically to prevent any cardio-embolic phenomenon, and then the patient was given a single shock with synchronized mode on at 100J, and to our surprise, the patient's heart rate reverted to back to normal sinus rhythm with a heart rate of 102 min^{-1}.

After synchronized cardio version

Repeat ECG: NSR, Normal Axis, LVH Pattern, Old ST-T Changes



Post cardio version vitals were taken, the SBP was still 80 mm Hg^{-1}.

TROP I: 0.00 (Negative)

ECHO: Severe LV Dysfunction with EF of 35%, no new changes

CHEM 8: Normal electrolytes and Kidney functions.

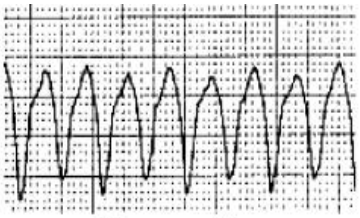
In view of cardiogenic shock, Inotropes – Inj. Dopamine infusion was started.

After reversion, Expert Cardiologist opinion was obtained and patient started on anti-arrhythmic agent. Inj. Lidocaine 100 mg IV stat followed by infusion at 5 mcg min^{-1}.

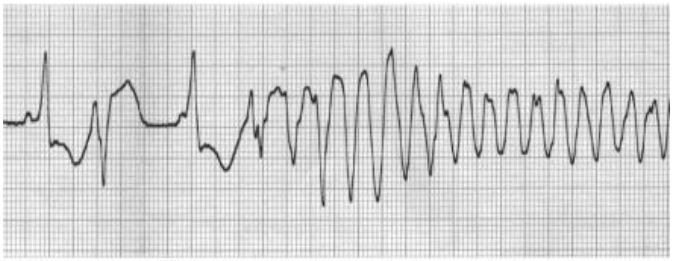
For further observation patient got shifted to the cardiac care unit and later assessed for need of device therapy for prevention of subsequent episodes.

3. Discussion

Ventricular tachycardia (VT) can be classified according to duration, morphology, and hemodynamic effect. Non-sustained VT terminates spontaneously without substantial hemodynamic compromise. Sustained VT is VT that lasts longer than 30 s and/or requires intervention for termination or produces severe hemodynamic compromise or syncope before terminating spontaneously. Ventricular tachycardia is described as monomorphic when each QRS complex resembles the next. When QRS complexes during tachycardia vary in appearance from beat to beat, VT is classified as polymorphic. Torsades de pointes are a form of polymorphic VT that is often associated with a prolonged QT interval [1].



Monomorphic



Polymorphic

When tachycardic rhythms fail to respond to pharmacologic treatment or present with or deteriorate into unstable manifestations, synchronized cardio-version is the treatment of choice.

Synchronized cardio-version is a procedure similar to electrical defibrillation in that a trans-thoracic electrical current is applied to the anterior chest to terminate a life-threatening or unstable tachycardic arrhythmia. Unlike defibrillation, which is used in cardiac arrest patients, synchronized cardio-version is performed on patients that still have a pulse but are hemodynamically unstable. It is used to treat both hemodynamically unstable ventricular and supraventricular rhythms. There are no contraindications to synchronized cardio-version.

The most common cause of sudden cardiac arrest in adults is pulseless ventricular tachycardia (VT) or ventricular fibrillation (VF). VT can also occur in the presence of a pulse; often, it is the precursor to VF. VT is characterized by rapid, wide (greater than 0.12 s) QRS complexes.

VT can be caused by coronary artery disease, hypertension, valvular heart disease, and cardiomyopathy. It can also be induced by a blow to the chest (commotio cordis) [2].

One will need a monitor and defibrillator with synchronized function.

Like defibrillation, synchronized cardio-version delivers a shock across the chest, either by placing a pair of manual paddles on the chest or through the application of adhesive "hands-free" pads [3]. Most current defibrillators utilize a biphasic waveform that allows for a lower energy level to be used to achieve effective cardio-version. Because of their greater ability to terminate ventricular dysrhythmias, defibrillators utilizing biphasic waveforms are preferred to those utilizing the older, monophasic waveform.

Synchronized cardio-version differs from defibrillation in two aspects: (1) the amount of energy needed to convert the rhythm is usually less than that required for defibrillation, and (2) the shock is delivered in a different part of the cardiac cycle.

When a patient is defibrillated, the energy is released through the paddles or hands-free pads immediately when the defibrillation button/s are pressed. The shock is delivered at whatever point the cardiac cycle happens to be in at that moment. If an electrical shock is provided during the relative refractory period (corresponding to the latter part of the T wave), it is possible to induce VF (the so-called "R-on-T Phenomenon"). This would result in a patient who originally had a pulse being put into cardiac arrest. To avoid inducing cardiac arrest in a patient with a pulse, synchronized cardio-version is performed instead of defibrillation. To perform synchronized cardio-version, the defibrillator is placed into the "synchronize" mode by pressing the appropriate button on the machine. This causes the monitor to track the R wave of each QRS complex that goes by. A synchronizing marker will appear above each QRS complex, indicating that the synchronize feature is active.

The appropriate energy level is then selected, and the discharge/shock button is pressed and held. The defibrillator does not release the shock immediately. Instead, it waits for the next R-wave to appear and delivers the shock at the time of the R-wave. This allows the shock to be provided safely away from the T wave, avoiding the R-on-T phenomenon.

The recommended energy levels used to perform synchronized cardio-version vary from 50 to 200 joules. Recalling the specific energy level for a particular sub-type of unstable tachycardia is difficult, especially in an emergent situation. The safest and easiest recommendation is to start at the lowest energy level (50 joules), and if the shock is unsuccessful, double the amount of energy used. In a refractory case, you will be at 200 joules after just three shocks

Conclusion

As early VT/VF and late sustained VT/VF were associated with a markedly increased risk of all-cause death at 30 days and 1 year after discharge despite revascularization [4]. The need of quick recognition and treatment of tachyarrhythmias for unstable patient like VT with pulse, is important to prevent to cardiac arrest.

If there are signs of instability:

(a). Hypotension with SBP <90 mm Hg^{-1},

(b). Syncopal episode,

(c). Shortness of breath,

(d). Chest pain,

(e). Confusion

We must consider synchronized cardio-version immediately for prompt reversal of rhythm.

While administering cardio-version, we must take appropriate safety measures like:

(a). Must keep a fully equipped airway trolley beside

(b). IV fluids

(c). Inotropes

(d). Intubation things ready

(e). CPR team on standby

If at any time the patient loses consciousness and stops breathing or it is impossible to find carotid pulse, defibrillation (DC SHOCK) is indicated to maximum setting and must immediately initiate early CPR starting with chest compressions.

As an emergency staff nurse, I am confident to recognize this abnormal rhythm and initiate the quick management of VT.

With the swift decision made in time, we reverted this patient to normal sinus rhythm within 20 min of arrival in the ED, and managed to save this man's life.

References

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