

## Nitroglycerine-responsive ischemic irregular premature ventricular contractions post-failure of antiarrhythmic drugs in hypertensive crises and first-degree heart block

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### Abstract

**Rationale:** Nitroglycerin is a proven ordinarily prescribed short-acting anti-ischemic and antihypertensive medication. Historically, it is a peculiar antiarrhythmic agent. Nitroglycerin is mitigating anginal chest pain in coronary artery disease. However, coronary artery disease is a likely considerable cause of premature ventricular contractions. The irregular premature ventricular contractions exemplify a remarkable electrocardiographic cardiac issue. Concomitant presence of both the first-degree heart block and ischemic irregular premature ventricular contractions in hypertensive crises is extremely rare. First-degree heart block may be risky.

**Patient concerns:** An elderly, heavy cigarette smoker, the male patient presented with simultaneous co-presence of ischemic irregular premature ventricular contractions with hypertensive crises and first-degree heart block.

**Diagnosis:** Ischemic irregular premature ventricular contractions with hypertensive crises and first-degree heart block.  
**Interventions:** Detailed physical examination, nitroglycerin intravenous infusion, electrocardiography, and echocardiography.  
**Outcomes:** Dramatic termination of ischemic irregular premature ventricular contractions with nitroglycerin intravenous infusion.

**Lessons:** Clearing the effective role of nitroglycerin as an antiarrhythmic drug in ischemic irregular premature ventricular contractions. Simultaneous concomitant the first-degree heart block and ischemic irregular premature ventricular contractions in hypertensive crises are extremely rare. The presence of first-degree heart block, ischemic heart disease, multi-formed, frequent, irregular premature ventricular contraction, hypertensive crises, elderly, and cigarette smoking are prognostic factors for the severity of the disease.

**Keywords:** Nitroglycerine; Ischemic irregular premature ventricular contractions; Coronary artery disease; First-degree heart block; Arrhythmia; Ischemic heart disease.

### Abbreviations

CAD: Coronary artery disease; ECG: Electrocardiograph; HTN: Hypertension; ICU: Intensive care unit; IHD: Ischemic heart disease; IVI: Intravenous infusion; NTG: Nitroglycerin; PVCs: Premature ventricular contractions; SCD: Sudden cardiac death; SHD: Structural heart disease.

### Introduction

Nitroglycerin (NTG) is an ancient commonly prescribed short-

acting anti-anginal agent [1]. Nitrates produce vasodilation with predominant venous effects on large capacitance vessels. They also increase coronary collateral circulation, increase aortic compliance, and conductance and blood flow to ischemic areas of the myocardium. Besides, nitrates alleviate anginal symptoms by directly influencing the coronary arteries, coronary collateral circulation, aortic compliance and conductance, and blood flow to ischemic areas of the myocardium [2]. Short-acting nitrates are beneficial in acute ischemic heart disease (IHD) and hypertensive crises [3]. Although

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NTG is a clinically effective therapy in this condition, its exact mechanism of action is still uncertain [4]. However, NTG may suppress the incidence of premature ventricular complexes (PVCs) in acute ischemic attack [5]. Nitroglycerin administration was associated with a significantly more rapid reduction in ventricular arrhythmias: 6 hours after onset of recording, the number of PVCs had declined to 39% of the baseline value [6]. PVCs are described as premature and bizarre-shaped QRS-complexes that are unordinary long (typically >120 msec) and seem wide on the ECG. The QRS-complexes are not forwarded by a P-wave, and the T-wave is usually large and directed in the opposite of the major deflection of the QRS [7]. PVC is a type of arrhythmia characterized by premature heart contractions arising in one of the ventricles [8]. PVCs are early depolarization of the myocardium emerging in the ventricle [8] due to an electrical impulse or ectopic rhythm from any part of the ventricles before the sinoatrial impulse has reached the ventricles [8]. Whatever, PVCs in absent structural heart disease (SHD) is not harmful if there is no risk factors [9]. Indeed, PVCs with SHD are considered a way to sudden cardiac death (SCD) [9]. Unfortunately, more-frequency PVCs carry a poor prognosis [9]. Multifocal and multiform PVCs are considered red flags and risk markers for SCD [9]. The presence of PVCs in patients of IHD is associated with a poor prognosis [9]. However, PVCs with established IHD may be viewed as a marker of disease severity or as an endpoint in the natural history of the disease process [9]. The presence of PVCs in patients of IHD is associated with a poor prognosis [9]. An according to the Joint National Committee (JNC 7-2003) for prevention, detection, evaluation, and treatment of high blood pressure, the hypertensive crisis is defined as the elevation of systolic blood pressure (SBP) >179 mmHg or diastolic blood pressure (DBP) >109 mmHg [10]. Moreover, hypertensive crises can be classified into hypertensive emergencies or hypertensive urgencies depending on the presence or absence of acute end-organ damage, particularly [11]. The most common presentations in hypertensive urgency are headache (22%) and chest pain (27%) followed by dyspnea (22%) in hypertensive emergencies [12]. End-organ damage can be defined as the acute damage and resulting dysfunction of the eyes (retinal hemorrhages, exudates, or papilledema), the brain (hypertensive encephalopathy), the heart (acute pulmonary edema), or the kidneys (acute renal failure). This differentiation is an extremely useful issue for clinical, management decisions, and prognostic effect on morbidity and mortality. Importantly, in hypertensive urgencies, the blood pressure should be reduced within 24-48 hours, whilst hypertensive emergencies require immediate blood pressure reduction to prevent irreversible end-organ damage [11]. PR interval measured from the standard electrocardiogram (ECG) indicates the time from the beginning of atrial depolarization to the start of ventricular depolarization [13]. Prolonged PR-interval or first-degree heart block in ECG is defined by PR-interval >200 ms. In most cases, it is due to delayed conduction in the AV node, although conduction delay in the atrium, the His-Purkinje system, or multiple sites may also share in the prolonged PR-interval [13]. Historically, prolonged PR-interval or first-degree heart block conventionally

was considered as a benign ECG finding in healthy individuals. But recent studies have proposed that it may be accompanied by rising of both mortality and morbidity [14].

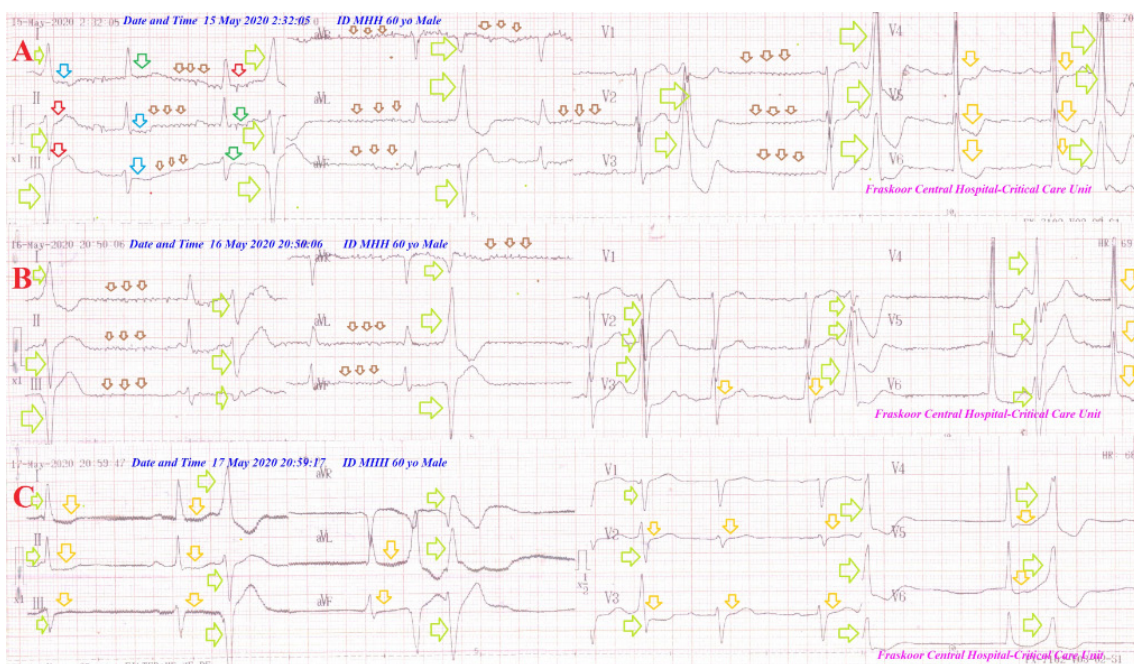
### Case presentation

A 60-year-old, heavy cigarette smoker, Egyptian painter, the male patient presented in the Emergency room with palpitation and chest pain. Sweating, tachypnea, and dizziness were associated symptoms. The chest pain was mild, pericardial, and on palpitation. The patient gave a history of recurrent tachycardia. He is a heavy cigarette smoker (20 cigarettes for about 18 years). The patient continued on diltiazem oral tablets (60 mg, once daily) and frusemide (40 mg, once daily). Informed consent was taken. Upon general physical examination; generally, the patient was anxious, with an irregular irregularly pulse and heart rate of VR; 78 bpm, blood pressure (BP) of 200/130 mmHg, respiratory rate of 22 bpm, the temperature of 36 °C, and pulse oximeter of oxygen (O<sub>2</sub>) saturation of 96%. The patient was admitted to the intensive care unit (ICU) as a hypertensive crisis with ischemic multi-formed irregular PVCs. No more relevant clinical data were noted during the clinical examination. Sublingual captopril oral tablets (25 mg; at once ) and O<sub>2</sub> inhalation (100%, by nasal cannula, 5L/min) was given. Within 30 minutes the blood pressure became 170/90 mmHg. The patient continued in the ICU on captopril oral tablets (25 mg; twice daily), bisoprolol oral tablets (5 mg; once daily), and amiodarone oral tablets (200 mg; twice daily ). Serial ECG tracings were done. The initial emergency ECG tracing was taken on the first day of the ICU admission showed multi-formed irregular PVCs in all leads ST-segment depression in V4-6 leads. A wavy triple sign (Yasser's sign) is seen in I, II, and III leads. There are tremor artifacts in leads. (Figure 1A). The second ECG tracing was taken on the second day of the ICU admission showed multi-formed irregular PVCs in all leads and ST-segment depression in V3-6 leads. There are still tremor artifacts in I, II, III, aVR, aVL, and aVF leads (Figure 1B). The third ECG tracing was taken on the third day of the ICU admission showed multi-formed irregular PVCs in all leads ST-segment depression in I, II, III, aVF, and V2-6 leads (Figure 1C). Within 3 days of the above treatment, the blood pressure became 140/80 mmHg but there are still frequent multi-formed irregular PVCs in all leads. The physician had started giving nitroglycerin IVI in a very low dose (10 mg/50 ml solvent, 5 ug/min) relatively for 30 minutes only. The ECG tracing was done in the ICU after three days of oral antiarrhythmic medications and within 30 minutes of starting NTG, IVI showed dramatic disappearance of all the above PVCs. Prolonged PR-interval is seen in lead II (280 msec). There are still coving ST-segment depression in I, aVL, and V5-6 leads (Figure 2). The requested workup was: Electrolytes profile show: Na<sup>+</sup>:147 mmol/l, K<sup>+</sup>: 3.7 mmol/L, ICA<sup>++</sup>: 1.2 mmol/L. Hb was: 12.4 gm/dl. Random blood glucose was: 117 mg/dl. The troponin test was negative (below the normal level). Thyroid function tests were normal. The echocardiographic report showed evidence of IHD with anterolateral wall hypokinesia with grade I diastolic dysfunction and normal ejection fraction (58%). Ischemic irregular premature ventricular contractions with hypertensive crises

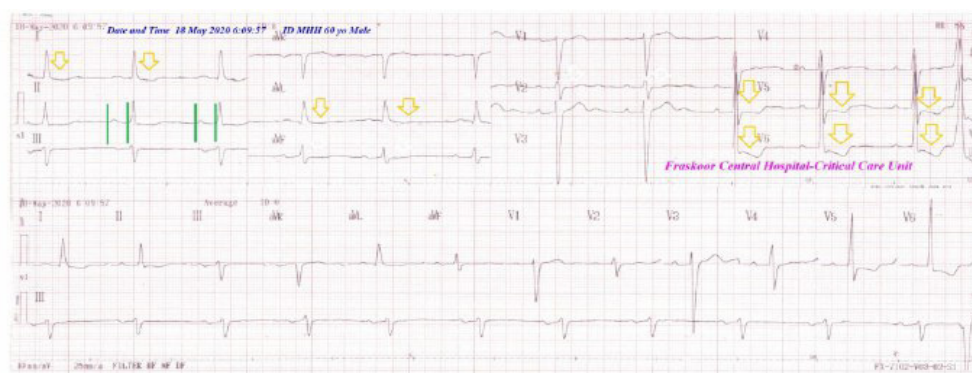
and first-degree heart block were the most probable diagnosis. The following drugs were prescribed for the patient on discharge; nitroglycerin retard capsules (2.5mg; twice daily), captopril oral tablets (25 mg; twice daily), bisoprolol oral tablets (5 mg; once daily), and aspirin oral tablets (75 mg, once daily) with no future problems. The patient was advised for future cardiovascular follow-up.

### Discussion

- Overview: An elderly, heavy cigarette smoker, the male patient presented with simultaneous co-presence of ischemic irregular premature ventricular contractions with hypertensive crises and first-degree heart block.



**Figure 1:** Serial ECG tracings; A. The initial ECG tracing was done on the first day of the ICU admission showed multi-formed irregular PVCs in all leads (lime arrows) and ST-segment depression in V4-6 leads (orange arrows). A wavy triple sign (Yasser’s sign) is seen in I, II, and III leads (red, green, and blue arrows). There are tremor artifacts in leads (small brown arrows). B. ECG tracing was done on the second day of the ICU admission showed multi-formed irregular PVCs in all leads (lime arrows) and ST-segment depression in V3-6 leads (orange arrows). There are still tremor artifacts in I, II, III, aVR, aVL, and aVF leads (small brown arrows). C. ECG tracing was done on the third day of the ICU admission showed multi-formed irregular PVCs in all leads (lime arrows) and ST-segment depression in I, II, III, aVF, and V2-6 leads (orange arrows).



**Figure 2:** The ECG tracing was done in the ICU after three days of oral antiarrhythmic medications and within 30 minutes of starting NTG IVI showed normalization of all the above PVCs. Prolonged PR-interval is seen in lead II (green vertical lines; 280 msec). There are still coving ST-segment depression in I, aVL, and V5-6 leads (orange arrows).

- The primary objective for my case study was the presence of a heavy cigarette smoker, an elderly male patient presented with simultaneous co-presence of ischemic irregular premature ventricular contractions with hypertensive crises and first-degree heart block in the ICU.
- The secondary objective for my case study was the question of; How did you manage the case at home?
- An elevation of BP of 200/130 mmHg will strengthen

the diagnosis of hypertensive crises.

- An existence of hypertensive crises with IHD was indicated for a type; emergency crisis.
- There are two varieties of the current ST-segment depression in the ECG. The first variety was coving form of ST-segment depression in the anterolateral (I, aVL, and V5-6) leads. It is mostly interpreted by hypertensive strain.

- The second variety was straight form ST-segment depression in the inferoseptal (II, III, aVF, and V2-4) leads. It is mostly interpreted as IHD.
- Emerging inferior developing prolonged PR-interval or first-degree heart block after antiarrhythmic medication (diltiazem, bisoprolol, and amiodaron) will be supporting the possibility of drug inducing.
- The presence of PR-interval or first-degree heart block will add a point of increasing the risk. But it changes the old think about the benign of first-degree heart block.
- There was a dramatic response of multi-formed, frequent, irregular PVCs to NTG IVI after the failure of oral diltiazem, bisoprolol, and amiodaron.
- Constellation of the first-degree heart block, ischemic heart disease, multi-formed, frequent, irregular PVCs, hypertensive crises, elderly, and heavy cigarette smoking is indicating a high-risk condition.
- An associated multi-formed, frequent, irregular PVCs will be raising the risk of mortality percentage.
- Acute coronary spasm (CAS) and acute myocardial infarction (AMI) were the possible differential diagnosis for the current case study.
- I can't compare the current case with similar conditions. There are no similar or known cases with the same management for near comparison.
- The only limitation of the current study was the unavailability of cardiac catheterization.

## Conclusions

- Clearing the effective role of nitroglycerin as an antiarrhythmic drug in ischemic irregular premature ventricular contractions.
- Simultaneous concomitant the first-degree heart block and ischemic irregular premature ventricular contractions in hypertensive crises are extremely rare.
- The presence of first-degree heart block, ischemic heart disease, multi-formed, frequent, irregular premature ventricular contraction, hypertensive crises, elderly, and heavy cigarette smoking are prognostic factors for the severity of the disease.

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**Conflicts of interest:** There are no conflicts of interest.

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