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CASE REPORT

Early Recognition and Intervention of De Winter Syndrome: A Case Report

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ABSTRAK

Sindrom de Winter merupakan satu keadaan yang jarang ditemui tetapi ianya seperti infaksi miokardium dengan peningkatan segmen-ST (STEMI) yang penting, yang dicirikan oleh penyempitan yang teruk pada saluran arteri koronari anterior kiri ke bawah (LAD). Kesilapan mudah berlaku semasa hendak mendiagnosa sindrom ini kerana corak elektrokardiogram (ECG) yang tidak tipikal, yang boleh menyebabkan kelewatan dalam memberikan rawatan reperfusi, seterusnya menyebabkan peningkatan kepada risiko kematian. Kami melaporkan satu kes di mana seorang lelaki berusia 38 tahun hadir ke Jabatan Kecemasan dengan bacaan ECG awal menunjukkan corak 'hyperacute T wave', tetapi kemudiannya berubah kepada corak sindrom de Winter setelah ujian ECG ulangan dilakukan. Pesakit segera dirujuk kepada pasukan kardiologi dan kemudiannya menjalani rawatan reperfusi iaitu 'percutaneous coronary intervention' (PCI) untuk membuka semula saluran darah yang sempit pada arteri LAD. Pesakit menunjukkan perubahan yang baik tanpa sebarang komplikasi selepas prosedur. Laporan ini bertujuan untuk memberi pencerahan berkenaan tentang kepentingan pengenalan awal, diagnosis dan rawatan yang betul dalam kes sindrom de Winter bagi mengelakkan komplikasi susulan.

Kata kunci: de Winter elektrokardiogram; infaksi miokardium dengan peningkatan segmen-ST; penyempitan saluran arteri koronari anterior kiri ke bawah; sindrom koronari akut

ABSTRACT

De Winter syndrome is a rare but important ST-elevation myocardial infarction (STEMI) equivalent, that is characterised by severe stenosis of the left anterior descending artery

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(LAD). It can be easily misdiagnosed due to its atypical electrocardiogram (ECG) pattern which causing a delay in reperfusion, hence increases risk of mortality. Herein, we reported a 38-year-old man presented to the emergency department (ED) with initial ECG showed hyperacute T wave, which later evolved to de Winter syndrome ECG pattern after serial ECG were done. He was immediately referred to the cardiology team and underwent immediate percutaneous coronary intervention (PCI) to revascularise the stenosis found at the left anterior descending artery (LAD). He showed good outcomes and no complication after the procedure. This paper aimed to shed light on the importance of early identification, right diagnosis and treatment in De Winter syndrome case to avoid complications.

Keyword: Acute coronary syndrome; de Winter electrocardiogram; LAD occlusion; ST-elevation myocardial infarction equivalent

INTRODUCTION

ST-elevation myocardial infarction (STEMI) electrocardiogram (ECG) pattern is well-recognised. However, coronary artery occlusion can present without typical STEMI changes, known as STEMI equivalent. In fact, about 25% of patients without STEMI ECG changes, have total coronary occlusion (Al-Zaiti et al. 2022). Therefore, about 30% of cases are clinically reported as misdiagnosis or missed diagnosis due to this atypical ECG (Lu et al. 2020).

De Winter syndrome is one of the STEMI equivalents. De Winter ECG pattern first recognised in 2008 with a characteristics of ST segment of 1 to 3-mm upsloping ST-segment depression at the J point in leads V1 to V6 that continued into tall, positive symmetrical T waves (de Winter et al. 2008). Majority of patients may have 1-2 mm ST-elevation in lead aVR. This pattern of ECG is associated with 2.0% of patient with anterior myocardial infarction and commonly recorded at around 1.5 hours after the onset of symptoms (de Winter et al. 2008). Another retrospective study found similar prevalence to be at 2% (Verouden et al. 2009)

De Winter syndrome requires emergency revascularisation similar to STEMI, otherwise it can lead to complications and high rate of mortality (Raja et al. 2019). Therefore, early clinical recognition of this finding and additional evaluation is critical to improving patient outcomes.

CASE REPORT

A 38-year-old Malay man, previously healthy, presented with a sudden onset of left-sided chest pain lasting 1 hour while at rest. The pain was persistent, heavy in nature, localised with no aggravating or relieving factors. This was his first episode of chest pain and associated with diaphoresis and left upper limb numbness. He denied any dyspnea, dizziness, nausea, vomiting, gastric reflux symptoms or failure symptoms. He was an active smoker. There was no family history of heart disease.

On examination, he was alert but in distress, with cool peripheries. His vital signs were as follows: blood pressure

(BP) of 110/83 mmHg, heart rate (HR) of 83 beats/minute, respiratory rate (RR) of 20 breaths/minute and SpO2 of 100% in room air. There was good pulse volume and regular rhythm without radio-radial delay. Jugular vein was not distended. On cardiac examination, apex beat was not displaced and normal heart sounds were heard during auscultation. Respiratory and abdominal examination were unremarkable. His initial ECG (Figure 1) showed a sinus rhythm with hyperacute T waves in leads V2, V3, V4 (anteroseptal leads). However, the ECG machine reported as a normal ECG.

A differential diagnosis of acute coronary syndrome, aortic dissection, acute pericarditis, pneumothorax, pulmonary embolism, and hyperkalemia were made. An Emergency Department (ED) bedside echocardiogram revealed hypokinesia of the anterior wall. There was no intimal flap or dilatation of the aortic root to suggest aortic dissection. The absence of an enlarged right ventricle and a flat interventricular septum reduced the likelihood of a pulmonary embolism. The chest radiograph revealed no signs of radiolucency around the lung's edge to suggest pneumothorax; neither cardiomegaly nor widening mediastinum were present. The serum potassium level was 3.9 mmol/L, hence the tall T-wave in his ECG was unlikely caused by hyperkalemia. A provisional diagnosis of acute coronary syndrome was made. He was immediately given intravenous (IV) morphine 2mg, sublingual glyceryl trinitrate 0.5 mg, T.Aspirin 300 mg and T.Clopidogrel 300 mg.

A serial ECG was done every 20 minutes, which the second and the third ECGs showed a similar pattern to the initial ECG. One hour later, the subsequent ECG

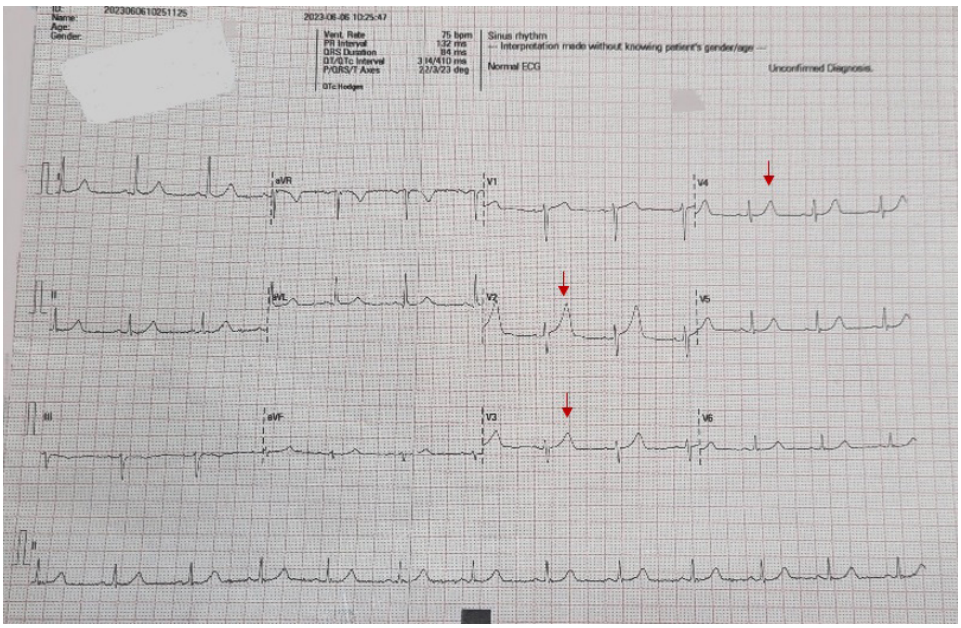

FIGURE 1: Initial electrocardiogram (ECG) showed hyperacute T wave at lead V2-V4

(Figure 2) showed upsloping ST-segment depression over V2-V6 with positive symmetrical T waves. The ECG pattern represented the de Winter syndrome. His troponin I value from an initial normal level of 2.1 pg/ml, raised to 48.6 pg/ml 3 hours after the onset of chest pain. His serum coagulation profile results were normal. Table 1 listed other blood test results.

Cardiology was immediately consulted and an emergency coronary angiography

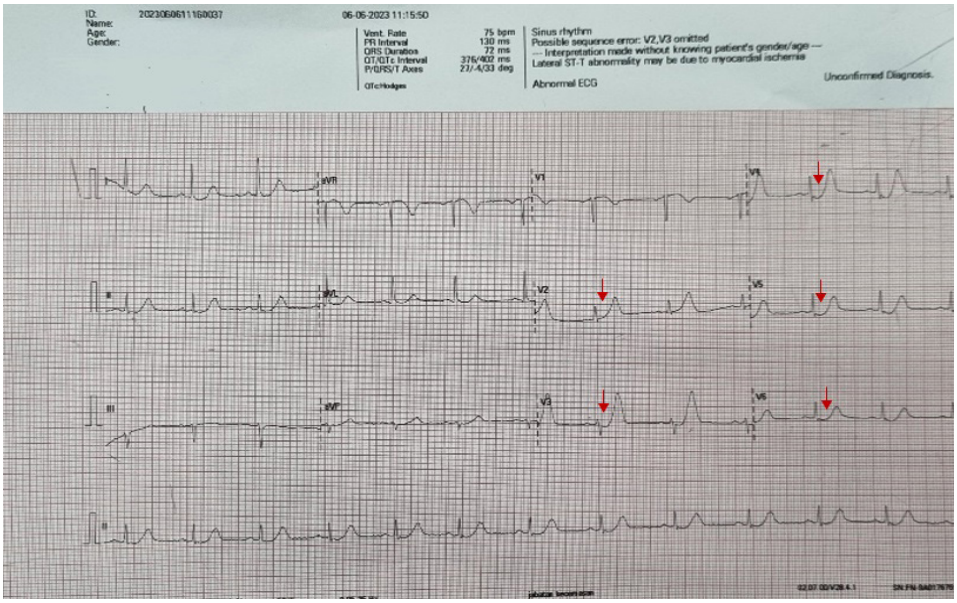

FIGURE 2: Repeated ECG showed de Winter syndrome pattern in leads V2-V6

TABLE 1: Initial blood investigations

Test	Results	Reference range	Test	Results	Reference range
Hemoglobin (g/dL)	15.3	13.0-17.0	Sodium (mmol/L)	138	136-145
White cell count ($x10^9$/L)	10.9	4-10	Potassium (mmol/L)	3.9	3.1-5.1
Hematocrit (%)	45.7	45.7	Albumin (g/L)	41	35-50
Platelet ($x10^9$/L)	283	150-410	Corrected calcium (mmol/L)	2.32	2.2-2.6
Urea (mmol/L)	3.8	3.2-7.4	Magnesium (mmol/L)	0.86	0.66-1.07
Creatinine (micromole/L)	83.2	64-104	Phosphate (mmol/L)	0.80	0.74-1.52
Troponin I (pg/ml)	2.1	<34.2	Prothrombin time (seconds)	12.5	11.6-14.9
APTT (seconds)	26.1	30.3-46.5	International normalised ration (INR)	0.9	

was performed. The findings showed severe diffuse disease from proximal to distal left anterior descending (LAD) artery with the proximal area of tight stenosis of 90% with calcium chunks (Figure 3A). He was successfully treated with percutaneous coronary intervention (PCI) without any complications (Figure 3B). A double antiplatelet treatment was started during his admission and continued for one year. The next day, his fasting lipid profile showed high total cholesterol of 5.84 mmol/l (normal range <5.2) and high low density lipoprotein (LDL) level of 4.34 mmol/l (normal range <3.8). He was discharged well after five days of admission. The patient experienced no major adverse cardiac events on subsequent follow-ups 6 months after the procedure.

DISCUSSION

Given the high mortality rate associated with acute myocardial infarction (AMI), ECG has a critical role in the diagnosis and risk assessment of patients who present with chest pain in the Emergency Department. In this case report, within an hour of onset, this patient's initial ECG showed tall and broad symmetrical T waves, which usually progress into ST elevation in the precordial leads. Nevertheless, two hours after the onset of symptoms, his ECG progressed into de Winter's ECG pattern, which is considered as STEMI equivalent.

De Winter's ECG pattern was first described in 2008 which was characterised by ST-segment depression at the J-point with upsloping ST-segments continuing into tall, symmetrical T waves at precordial leads (de Winter et al. 2008). Some may have 1-2 mm ST-elevation in lead aVR. De Winter ECG pattern had a high positive predictive value of 95.2% (Morris & Body 2017). Other common differential diagnoses for tall T-waves are occlusive myocardial infarction (OMI) and hyperkalemia (Somers et al. 2002). Hyperacute T-waves in OMI are regionally distributed and may be associated with

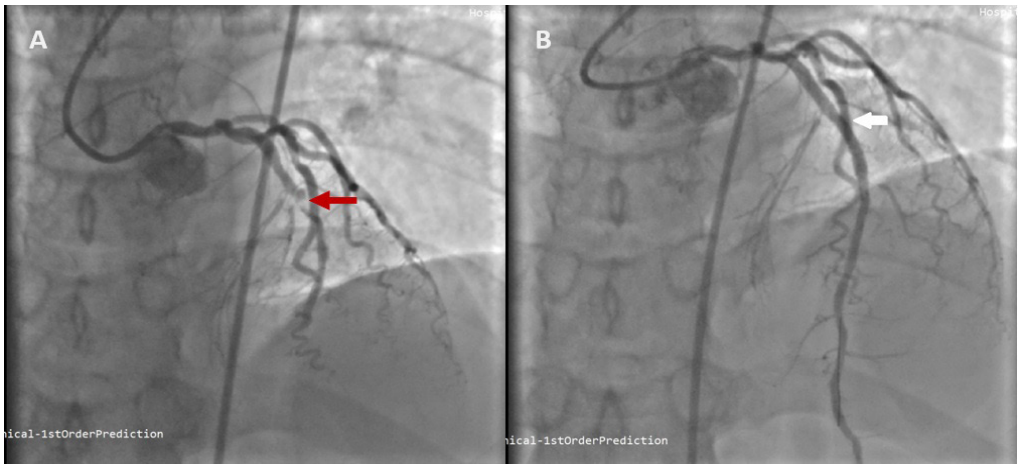

FIGURE 3: (A) A coronary angiogram revealed tight stenosis of 90% at the proximal left anterior descending (LAD) (red arrow); (B) The lesion was treated by PCI (white arrow) and showed a complete filling of the distal LAD

other occlusive signs such as Q waves, loss of R waves, ST-segment elevations or the presence of reciprocal ST-segment depression (Levis 2015). Meanwhile, in hyperkalemia, the T-wave is described as sharp peak with narrow base and can be associated with other signs of hyperkalemia such as bradycardia, junctional rhythm, a long PR, or wide QRS complex (Levis 2015). The tall T-wave of de Winter differs in terms of its association with the upsloping of ST depression (de Winter et al. 2008). This pattern is postulated to occur due to there is a delay in repolarisation in the subendocardial region, with a change in the transmembrane action potential shape due to hypoxic-driven alteration in the ATP-dependent potassium channels (Liu et al. 2022).

This patient's ECG showed upsloping ST segment depression at V2-V6, but no ST segment elevation in aVR. This could lead to a misdiagnosis of non-STEMI (NSTEMI) and hence would delay the reperfusion therapy. Patients with acute coronary occlusions without STEMI criteria suffer double mortality due to delayed revascularisation (Meyers et al. 2021).

A serial ECG is crucial in patients with chest pain since it aids in detecting transient ischemia and predicting adverse events (Lehmacher et al. 2020). We identified the de Winter ECG pattern after 3 serial ECGs within 1 hour, which led to early referral to cardiology.

This patient's initial ECG was reported as a normal ECG by the machine and his troponin I initial result was normal. This adds a diagnostic challenge in the presence of atypical ECG which could lead to missed or delayed diagnosis (Lu et al. 2020). Hence, it is important for a clinician to exercise their clinical acumen by considering the patient's symptoms, conducting a comprehensive physical examination, and meticulously interpreting the ECG, rather than solely relying on the automated reporting of the ECG machine. The initial echocardiography revealed a regional left ventricle wall motion abnormality (LVWMA), indicating a likelihood of acute coronary syndrome. Consequently, he received early pharmacotherapy. Therefore, the use of echocardiography is recommended by international guidelines to support the diagnosis of acute coronary syndrome, especially in the event of doubt (Manfredonia et al. 2019). However, routine standard echocardiography did not significantly improve the accuracy of diagnosing acute coronary occlusion in patients presented with chest pain (Manfredonia et al. 2019).

Door-to-balloon time for STEMI should be less than 90 minutes (Rajadurai 2019). Hence, similar management for de Winter syndrome patients as the actual occlusion needs to be managed within the same time. Early primary percutaneous coronary intervention (PPCI) is the treatment of choice for its better clinical outcomes compared to thrombolysis (Raja et al. 2019). This patient was fortunate as he presented to a cardiac center with PCI facility. However, a case reported by Parthiban and Sani (2022) opted for thrombolysis therapy prior to transfer to a cardiac center for immediate PCI post thrombolysis, as an alternative emergent reperfusion strategy in non-cardiac centers. However, the role of thrombolysis is still a controversial topic and requires more evidence to support its use as de Winter wave ECG is currently not an indication for thrombolysis in the

latest guidelines (Shahri et al. 2022).

Early identification of de Winter syndrome ECG pattern by the ambulance paramedics is important during their emergency response. This provides a benefit of early activation of the cardiac center for early PCI and pharmacotherapy administration can be done (Toro et al. 2020).

Patients' characteristics of de Winter syndrome compared to STEMI were men, younger age group (means age of 52) compared to 61 in STEMI, having hypercholesterolemia and active smokers (Raja et al. 2019). There were several cases of de Winter syndrome reported on younger male patients, for instance a previously healthy 31-year-old man (Sunbul et al. 2015) and a 36-year-old man (Zhao & Huang 2018), both with history of smoking. Therefore, young age, history of active smoking and high cholesterol levels should serve as reminders of an association with de Winter syndrome.

This case highlights the diagnostic challenges and success in diagnosing and managing acute coronary syndromes with non-ST elevation ECG pattern. Comprehensive approach of serial ECG, utilisation of bedside echocardiogram and prompt identification of de Winter ECG pattern are crucial for timely management. The successful PCI without complications, along with the initiation of double antiplatelet treatment highlights the effectiveness of timely intervention in improving clinical outcomes of this patient.

CONCLUSION

Clinicians should exercise their clinical suspicion based on the patient's symptoms, physical examination, and recognition of the de Winter ECG pattern when a patient presents with chest pain, instead of relying on the automated reporting of the ECG machine and a troponin level. This will help to prevent misdiagnosis. A serial ECG and a bedside echocardiography are excellent bedside diagnostic aids for speedy diagnosis. Early diagnosis is crucial for prompt reperfusion therapy, which ultimately saves lives and improves patient outcomes.

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