CASE REPORT

INFEROPOSTERIOR ST-ELEVATION MYOCARDIAL INFARCTION IN A PATIENT WITH FRANK'S SIGN: A CASE REPORT

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Abstract: Coronary artery disease (CAD) is one of the main global causes of death. Early diagnosis by physical examination may play important role to identify population at risk and reduce morbidity and mortality. Diagonal Ear Lobe Crease (DELC), also known as Frank's sign, was observed to be associated with coronary artery disease. We report a case of patient who presented with inferoposterior STEMI and findings of bilateral DELC. A systematic literature search was conducted to identify the latest evidence and its implications for clinical practice.

Keywords: Frank's Sign, Coronary Artery Disease, Acute Coronary Syndrome, Diagnostic, Prognosis

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INTRODUCTION

Cardiovascular disease is one of the leading non-communicable diseases contributing to substantial morbidity and mortality worldwide.[1] Thus, to mitigate them, identifying the population at risk is an important task. Through physical examination, we can identify a population at risk of ischemic heart disease (IHD) and myocardial infarction (MI). Diagonal ear lobe creases (DELC), eponymously coined as Frank's sign, is one of several notable signs associated with IHD and MI.[2,3] Herein, we report a patient who presented with inferoposterior ST Elevation Myocardial Infarction (STEMI) and findings of bilateral DELC.

CASE REPORT

A 46-year-old man came to the emergency room (ER) one hour before the presentation with chest pain. The chest pain was described as pressure on the chest with radiation to the left arm and back. He also complained of diaphoresis, epigastric tenderness, dry cough, nausea, and has vomited four times. He denied a family history of premature atherosclerotic cardiovascular disease. His social history was only significant for 40-pack-year smoking history.

On initial presentation in the emergency room, his vitals were within normal limits, except for his heart rate of 55 beats per minute with a regular rhythm. Physical examination was significant for the distended jugular vein, wheezing, and rales <50% of the lung fields. No murmurs, cardiac rubs, or gallop on auscultation. There was no tenderness on palpation of the chest wall or lower extremity edema. The patient's initial ECG (Figure 1) showed ST elevations on the inferior (III, aVF) and ST depression on anterolateral leads (V2 -V6, 1, aVL). The posterior ECG showed ST elevation on the posterior chest leads. Thus, he was diagnosed with inferoposterior STEMI with Killip Class II.

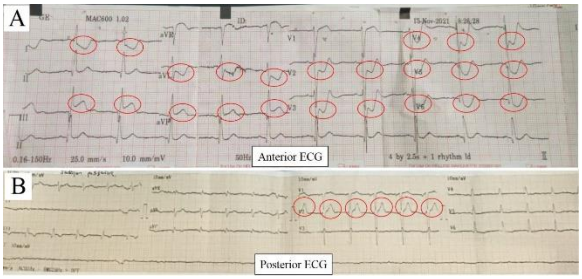

Figure 1: Patient's initial ECG in the Emergency Room: (A) The 12-lead ECG showed ST elevations on the inferior (III, aVF) and ST depression on anterolateral leads (V2 -V6, 1, aVL). (B) The posterior ECG showed ST elevation on the posterior chest leads

In the ED, he was given loading doses of dual antiplatelets (320 mg of aspirin and 300 mg of clopidogrel). His fibrinolytic checklist showed no absolute contraindications. He was started on a fibrinolytic (streptokinase 1.5 million units in 100 ccs of 0.9% normal saline for 60 minutes) and subsequently was admitted to the intensive care unit for close monitoring. His chest x-ray (CXR) showed severe pulmonary edema with secondary infection. His laboratory findings were significant for elevated Creatine Kinase Myocardial Band (CK-MB),

leukocytosis with neutrophilia, and high lipid profile levels (Table 1).

Unfortunately, we did not perform echocardiography and coronary angiography as both are unavailable in our hospital. He was also diagnosed with community-acquired pneumonia, dyspepsia, and acute exacerbation of asthma. Therefore, other than the standard guideline-directed medical therapy for STEMI (dual antiplatelet once daily, subcutaneous low-molecular-weight heparin (LMWH) twice daily, atorvastatin once daily), he received intravenous loop diuretics, an intravenous antibiotic, and symptomatic treatment for his symptoms.

Table 1: Patient's laboratory findings during hospitalization

Laboratory Test	Results	Normal Value
Hemoglobin (g/dL)	15.6	11.5 – 16.5
Hematocrit (%)	44.1	37.0 – 47.5
White blood count (/mm3)	15.8000	4.00 – 11.00
Platelets (/mm3)	275.000	150.00 – 450.00
Lymphocyte (10^3 µL)	1.93	1.50 – 4.00
Monocyte (10^3 µL)	0.87	O.20 – 0.60
Eosinophil (10^3 µL)	0.13	0.00 – 0.40
Basophil (10^3 µL)	0.02	0.00 – 0.10
Neutrophil (10^3 µL)	12.85	2.00 – 7.50
Natrium (mmol/L)	143	136 – 145
Potassium (mmol/L)	4.2	3.5 – 5.0
Chloride (mmol/L)	108	98 – 107
ALT (U/L)	35	10 – 40
Creatinine (mg/dL)	1.05	0.7 – 1.3
CKMB (U/L)	40	5 – 25
Total cholesterol (mg/dL)	278	<200
HDL (mg/dL)	35	>40
LDL (mg/dL)	172	<100
Triglyceride (mg/dL)	354	<150
Uric acid (mg/dL)	4.57	3.0 – 7.0

The patient's laboratory findings were insignificant, except elevated CKMB, leukocytosis with neutrophilia, and high lipid profile levels

On the second day, the patient's condition stabilized. The chest pain intensity has greatly reduced as well as his other symptoms. Significant findings of the physical examination were non–distended jugular vein and reduced lung fields area of wheeze and rales. Notably, on the second day of follow-up, during the grand rounds, we noticed diagonal creases running across at a 45-degree angle from the tragus to the auricle on both of his earlobes. The creases were more prominent on the right side of his earlobes. We tried to elicit a history of these findings, but the patient did not know when the creases started to appear. He also did not know whether his parents nor his first-degree relatives had these creases.

The patient underwent an uneventful course of disease during his hospitalization for five additional days in the ICU, and he was transferred to non-intensive care unit after his condition improved. His hospitalization concluded with ten doses of subcutaneous enoxaparin, twice daily (1mg/kgs of body weight) and ten doses of intravenous ceftriaxone, one gram, twice daily. He was discharged with antiplatelet drugs (80 mg aspirin and 75 mg clopidogrel daily), 40 mg of atorvastatin daily at night, and 2.5 mg of bisoprolol daily in the morning and was scheduled for outpatient follow-up in the clinic. The patient was then advised to be referred for elective percutaneous coronary intervention.

DISCUSSION

Frank's sign or DELC was first coined by the American Pulmonologist Sander T. Frank in 1973.[2] Since then, a large body of evidence has existed regarding this sign. An extensive review regarding it is out of the scope and purpose of this case report and has been reported elsewhere. Thus, we review the latest evidence up to the last five years. Through a systematic literature search in PubMed with the following keywords: Frank's Sign OR Diagonal Earlobe Crease AND Coronary Artery Disease OR Coronary Heart Disease OR Atherosclerosis OR Atherosclerotic Heart Disease OR Atherosclerotic Cardiovascular Disease OR Acute Coronary Syndrome. Several articles were selected to generate the latest body of evidence (Figure 2).

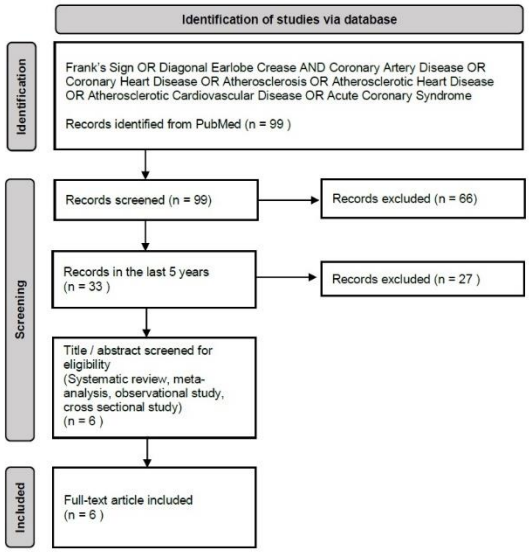

Figure 2: Flowchart of systematic literature search in PubMed

First, we underscore the update on the pathophysiology of DELC. Although many theories existed,[4] a histopathological study showed that arterial myoelastofibrosis, Wallerian degeneration in peripheral nerves, and deep-tissue fibrosis support hypoxia and reoxygenation injury as ear lobes lack end arteries, similar to coronary arteries.[5] Others also

suggested the association of low Adropin and Irisin, polypeptide hormones pertinent to human energy metabolism and vascular homeostasis, with the presence of DELC.[6]

Secondly, we examine the observational studies and one systematic review on DELC, CAD, and acute coronary syndrome. Three main themes were generated from these studies of DELC, i.e., diagnostic, therapeutic, and prognostic implications.

Diagnostically, based on a systematic review, DELC only modestly increases the pre-test probability in patients with a high clinical likelihood of obstructive coronary artery disease.[7] Based on collected data, sensitivity and specificity of DELC showed notable heterogeneity. Sensitivity ranged from 26% to 90%, and specificity from 32% to 96%, whereas calculated positive and negative likelihood ratios were more consistent. The conclusion of the systematic review is limited to different definitions of DELC that were used (unilateral/ bilateral) and included old studies published over 40 years ago. Nevertheless, the authors concluded that identification of DELC should be incorporated in the routine physical exam as it is easy to perform.[7]

Therapeutically, a high DELC score is correlated with more complex coronary lesions. In a cross-sectional study, Liu et al. showed that a higher DELC score was correlated with intermediate and high-risk SYNTAX scores.[8] SYNTAX score is based on the coronary angiographic findings, and an increased score is associated with complex coronary lesions. The score is graded from 0 – 4 points and comprise of four variables, i.e., Left Vertical Crease – Dividing Earlobe and Faces (LVC-EF), Right Vertical Crease – Dividing Earlobe and Faces (RVC-EF), Left Crossing Creases Not originated from the Ear Hole (LCC-NEH), and Right Crossing Creases Not Originated from the Ear Hole (RCC-NEH). Accordingly, our patient has a score of 4 out of 4 (Figure 3).

Finally, related to the prognostic function of DELC, the KORA Myocardial Infarction registry showed that the higher DELC grade (2/3) was associated with a 2.57 times increase in the hazard ratio of death in one year.[9] Shortly, the grading system is explained as follows: grade 0 is no visible crease, grade 1 is any crease less than grade 2, grade 2a is a diagonal crease greater than 50% but less than 100% across the lobe, grade 2b is a complete and superficial diagonal crease, and finally grade 3 is a complete and deep diagonal crease.

Related to our case, the patient's diagonal crease was 100% across the lobe and deep. Therefore, it was grade 3, which translated to an increased risk of death one year after MI. Although not the main focus, we briefly highlight that our patient also presented a newer sign of CAD, i.e., paired ear creases of the helix (PECH). The sign is described in detail elsewhere.[10]

In conclusion, despite rapid technological advancement in medicine, a physical examination still plays an integral part in diagnosing. Frank's sign is unequivocally associated with CVD and can be easily identified in a physical examination. Therefore, clinicians should be cognizant of this innocuous sign, as it may lead to a better diagnostic approach and therapeutic implications.

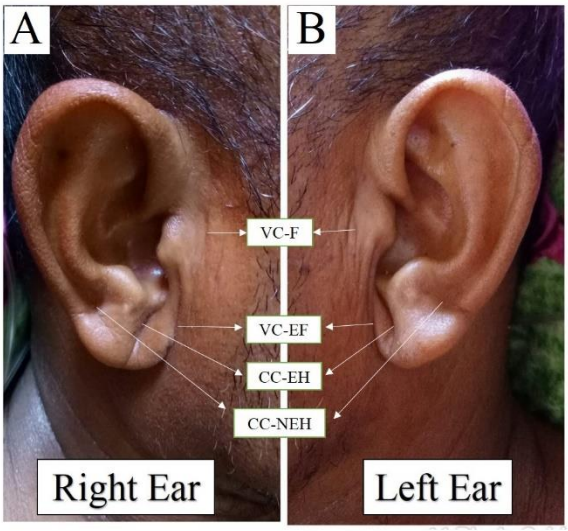

Figure 3: The bilateral DELC (Frank's sign): Four specific types of ear creases (arrows) - crossing crease not originated from ear hole (CC-NEH), crossing crease originated from ear hole (CC-EH), vertical creases on the face side (VC-F), and vertical creases dividing earlobe and face (VC-EF). (A) Right ear, (B) Left ear

AUTHORS' CONTRIBUTION

JH and AC: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. MT, AW, and AP: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

Conflict of interest: Authors declared no conflict of interest.

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