

## CASE REPORT

## Electrocardiographic clue for a mid-LAD lesion

Rohat Ak,<sup>1</sup> Fatih Doganay,<sup>1</sup> Ozge Ozberk Onur,<sup>2</sup> Ebru Unal Akoglu<sup>1</sup>

<sup>1</sup>Department of Emergency Medicine, Fatih Sultan Mehmet Education and Research Hospital, Istanbul, Turkey  
<sup>2</sup>Department of Emergency Medicine, Marmara University, Istanbul, Turkey

Correspondence to  
 Dr Ebru Unal Akoglu,  
 ebrunal@gmail.com

Accepted 3 March 2016

**SUMMARY**

ECG is still the first diagnostic tool for coronary artery disease. It is possible to predict the localisation of affected vessel(s) through ST and T changes on ECG. Sometimes, reciprocal changes may be the only marker of acute myocardial ischaemia, as single T-wave inversion in lead aVL may represent a coronary artery lesion in the left anterior descending (LAD). A 49-year-old woman presented to the emergency department, with left-sided chest pain. Her initial ECG showed no ischaemic changes. On the third hour ECG there was T-wave inversion in leads aVL and V2, and troponin turned positive. Coronary angiography showed 90% mid-LAD occlusion. The importance of this case is that patients with ischaemic chest pain should be followed with serial ECG. Also, emergency physicians should be alert to identify new changes on ECG, as isolated T-wave inversion in lead aVL can be the only finding to take the patient into the catheterisation laboratory.

Lead aVL change, which has recently proved to be accurate through case notifications, is one of them; however, it has still not attracted much notice. The only finding in ECG for acute MI might be ST-depression.<sup>2</sup> Moreover, T-wave inversion in lead aVL might be the only sign of a left anterior descending artery (LAD) lesion.<sup>3</sup> The purpose of this case is to emphasise the importance of isolated ST changes in lead aVL and to point out the benefits of encouraging emergency physicians to use early invasive intervention for these patients.

**CASE PRESENTATION**

A 49-year-old woman with a history of hypertension was admitted to the emergency department, with chest pain and shortness of breath for 15 min. Her medical history included only hypertension. Vital signs were as follows—temperature 36.2°C, blood pressure 158/101 mm Hg, pulse 87/min and oxygen saturation 99%. She reported a substernal chest pain radiating to her left shoulder. Physical examination was unremarkable. Her initial ECG showed normal sinus rhythm (NSR) and no ischaemic changes (figure 1). In the laboratory investigation, the level of serum electrolytes, troponin value, complete blood count, coagulation and other biochemical values were normal. The thrombolysis in MI score determined for the patient was 1. There was no significant feature observed in her chest X-ray. A controlled ECG showing NSR and new onset T-wave inversion in lead aVL and V2 (figure 2.) Transthoracic echocardiography revealed left ventricular segmental contraction disability

**BACKGROUND**

ECG is still the first examination for coronary artery diseases in the changing and developing medical environment. As it is possible to predict the localisation of a coronary artery that is affected by means of diagnosing acute myocardial infarction (MI) through looking at the elevations of ST-segment in ECG, it is also possible to predict the localisation of the coronary artery that is affected by reciprocal ECG changes including ST depression and T-wave inversion.<sup>1</sup> Sometimes, the reciprocal changes can be the sole sign of acute MI.

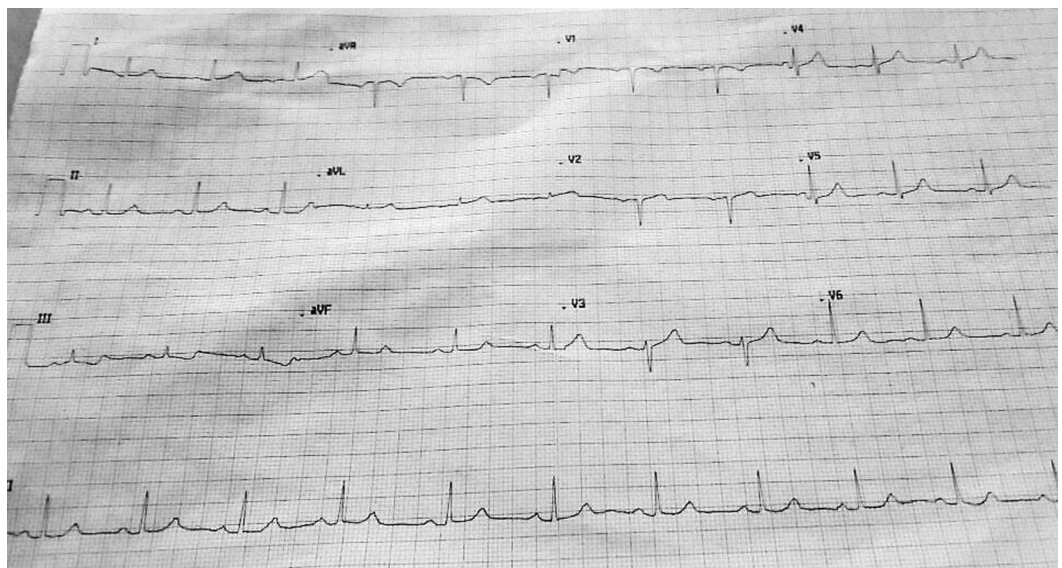
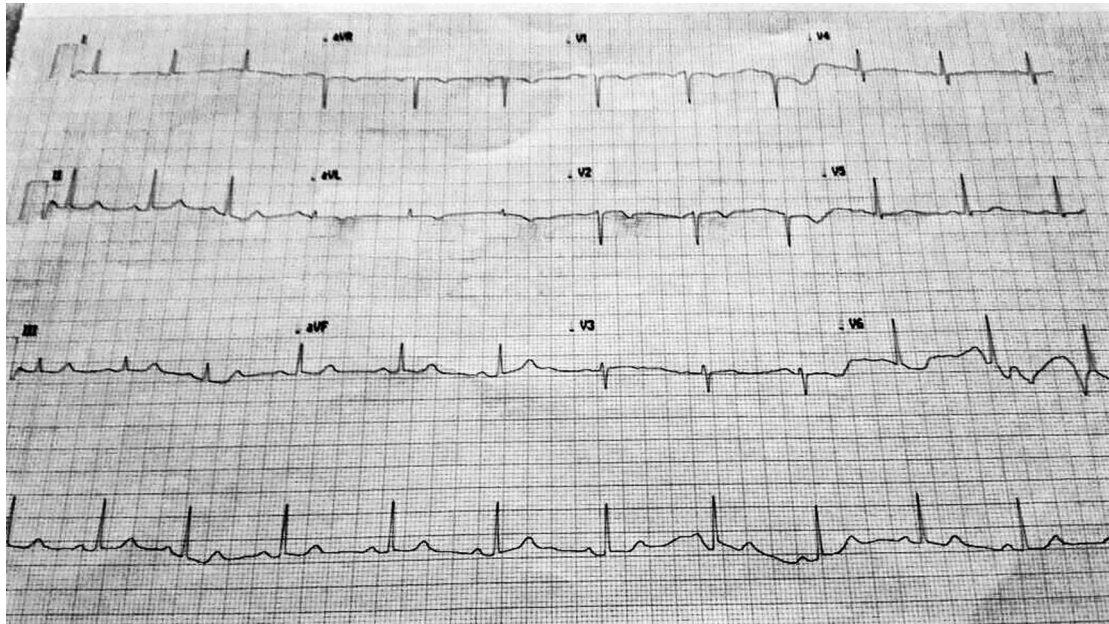


Figure 1 Twelve-lead ECG at presentation showing normal sinus rhythm and no ischaemic change.



To cite: Ak R, Doganay F, Onur OO, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2015-213046



**Figure 2** Dynamic T-wave changes on ECG; T-wave inversions in leads aVL and V2.

(apex hypokinetic) and the ejection fraction was 50%. Meanwhile, the control troponin value (3rd hour) was 0.39 ng/mL (normal interval 0–0.03 ng/mL). The patient was given acetylsalicylic acid, clopidogrel and unfractionated heparin and sent for emergency cardiac catheterisation. Angiography revealed a 90% mid-LAD and 50% ostial LAD lesions, and she received a stent (figures 3 and 4).

**DISCUSSION**

ECG provides data for use in detecting acute coronary syndrome, the coronary arteries affected by the acute coronary syndrome and the severity of myocardial ischaemia. Sometimes it is possible to diagnose these using the first ECG, whereas other times it is diagnosed by repetitive ECG, as in this case.

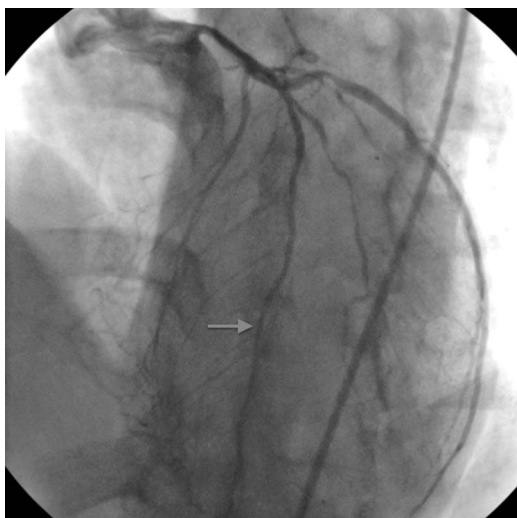
Although immediate cardiac catheterisation is suggested for ST elevation MI (STEMI) in the guidelines, recently it has been suggested to have immediate cardiac catheterisation in case of

de Winter’s T-waves (symmetric T-waves with down-sloping ST depression in precordial derivations), left main coronary artery occlusion (ST elevation with common ST depression in aVR) and Wellens findings, which is regarded as the STEMI equivalent.<sup>4</sup>

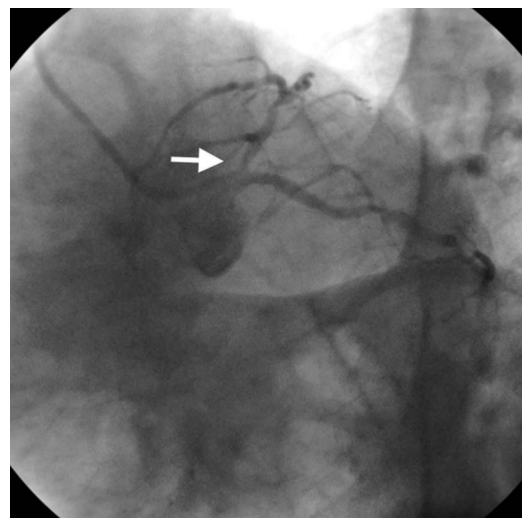
The first marker for inferior MI might be a T-wave change in lead aVL; it might also be seen as the first finding in mid-LAD lesion. However, this important finding is not well-known and has not been put into practice.<sup>5</sup>

In a study by Hassen *et al*,<sup>6</sup> an ECG, including isolated T-wave inversion in lead aVL, was shown to 191 doctors, and 143 of them (74.9%) interpreted it as normal.

Farhan *et al*<sup>7</sup> analysed ECGs of 191 patients with chronic stable angina having cardiac catheterisation; the authors stated that only 14.1% of the patients had isolated T-wave inversion in lead aVL and emphasised that it has high-predictive value for showing mid-LAD lesions.



**Figure 3** Coronary angiography showing mid-left anterior descending lesion (white arrow).



**Figure 4** Coronary angiography showing ostial left anterior descending occlusion (white arrow).

Isolated T-wave inversion in lead aVL is not always a pathological finding, it might appear as a normal finding. The incidence in the general population is not well known, however, it is reported to be 10–20% in the Caucasian population in Scotland.<sup>8</sup> Therefore, it would be better to use certain kinds of qualitative and quantitative definitions in order to recognise whether T-wave inversion is normal or pathological. For example, it is stated that Pardee T-waves (refer to minimal ST segment elevation at onset and mid-portion  $\geq 0.02$  mV above isoelectric line and T-wave inversion  $\geq 0.06$  mV in one of the precordial leads V1–V6), defined by Pardee, have high predictive value for ischaemic heart diseases.<sup>9</sup>

### Learning points

- ▶ ECG is still the first diagnostic tool for coronary artery disease and dynamic changes in ECG are important in diagnosis of myocardial ischaemia.
- ▶ It is possible to predict the localisation of affected vessel(s) through ST and T changes on ECG. Sometimes, reciprocal changes may be the only marker of acute myocardial ischaemia.
- ▶ The first reciprocal marker for inferior wall myocardial infarction or mid-left anterior descending lesion may be T-wave change in lead aVL.
- ▶ It would be better to reassess the patients by repetitive ECG and enzymes since there might be isolated T-wave inversion in lead aVL even in the normal population.

One of the points to be emphasised in this case is the importance of repetitive ECG for those patients describing chest pain, especially with ischaemic features, even if the first ECG and/or enzymes were observed to be normal. Combination of the clinical status, risk factors and patients' symptoms with T-wave changes may suggest ischaemic heart disease.

**Contributors** RA conceived of the case. RA and FD initiated the case design and OOO and EUA helped with implementation. All the authors approved the final manuscript.

**Competing interests** None declared.

**Patient consent** Obtained.

**Provenance and peer review** Not commissioned; externally peer reviewed.

### REFERENCES

- 1 Glancy DL, Doghmi W. Use of indicative and reciprocal electrocardiographic changes to help localize the site of coronary occlusion. *Proceedings (Bayl Univ Med Cent)* 2001;14:104–5.
- 2 Kracoff OH, Adelman AG, Oettinger M, *et al.* Reciprocal changes as the presenting electrocardiographic manifestation of acute myocardial ischemia. *Am J Cardiol* 1993;71:1359–62.
- 3 Hassen GW, Costea A, Smith T, *et al.* The neglected lead on electrocardiogram: T wave inversion in lead aVL, nonspecific finding or a sign for left anterior descending artery lesion. *J Emerg Med* 2014;46:165–70.
- 4 Birnbaum Y, Wilson JM, Fiol M, *et al.* ECG diagnosis and classification of acute coronary syndromes. *Ann Noninvasive Electrocardiol* 2014;19:4–14.
- 5 Birnbaum Y, Sclarovsky S, Mager A, *et al.* ST segment depression in aVL: a sensitive marker for acute inferior myocardial infarction. *Eur Heart J* 1993;14:4–7.
- 6 Hassen GW, Costea A, Carrasco C, *et al.* Isolated T wave inversion in lead aVL: an ECG survey and a case report. *Emerg Med Int* 2015;2015:250614.
- 7 Farhan HL, Hassan KS, Al-Belushi A, *et al.* Diagnostic value of electrocardiographic T wave inversion in lead aVL in diagnosing coronary artery disease in patients with chronic stable angina. *Oman Med J* 2010;25:124.
- 8 Macfarlane PW. Specialized aspects of ECG. In: *Medicine cardiology & angiology*. London, UK: Springer, 2012.
- 9 Kraft M, French WJ, Laks MM. Use of the computer to detect the pardee T wave: frequent marker of coronary artery disease. *J Electrocardiol* 1992;24:50–3.

Copyright 2016 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit

<http://group.bmj.com/group/rights-licensing/permissions>.

BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact [consortiasales@bmjgroup.com](mailto:consortiasales@bmjgroup.com)

Visit [casereports.bmj.com](http://casereports.bmj.com) for more articles like this and to become a Fellow