Heed the warning: Wellens' type T-wave inversion is caused by proximal left anterior descending lesion

D. LUKE GLANCY, MD, BAHIJ KHURI, MD, AND BRIAN COSPOLICH, MD

A 43-year-old hypertensive man came to the emergency department soon after an episode of severe chest pain, and serial electrocardiograms were obtained (*Figures 1–3*). He was treated with oxygen, aspirin, intravenous heparin, an intravenous beta-blocker, nitrates, and an angiotension-converting enzyme inhibitor. The total creatine kinase peaked on hospital day 1 at 848 U/L with a creatine kinase-MB fraction of 64.5 ng/mL. Troponin I peaked on hospital day 2 at 43.7 ng/mL. During coronary arteriography on hospital day 4, the expected left anterior descending (LAD) lesion was not found. The first and largest obtuse marginal branch of the left circumflex was noted to be significantly narrowed at its origin, and on hospital day 9, it was stented with a 3 × 15-mm Arterial Vascular Engineering stent (*Figure 4*). The patient was discharged 2 days later on as-

pirin, ticlopidine, a long-acting nifedipine, a long-acting nitrate, and a beta-blocker.

Five days after his discharge, the patient returned with chest pain, and the electrocardiogram and coronary arteriography were repeated (*Figures 5 and 6*). The total creatine phosphokinase peaked that day at 4660 U/L with a creatine kinase-MB fraction of 374 ng/mL and troponin I of 156 ng/mL. Bypass of the lesion at the origin of the LAD was subsequently performed using the left internal mammary artery.

T-wave inversion in the anterior precordial leads takes many forms, has multiple causes, and is a normal variant in the persistent juvenile T-wave pattern. In 1982 de Zwaan et al called attention to the specificity of a unique type of anterior T-wave inversion for ischemia and/or injury in the distribution of the

Figure 1. Electrocardiogram done in the emergency department on hospital day 1 shows sinus rhythm, huge QRS voltage in the precordial leads indicating left ventricular enlargement, and terminal T-wave inversion V_2 – V_4 that is virtually pathognomonic for very recent ischemia or injury in the distribution of the left anterior descending coronary artery.

From the Section of Cardiology, Department of Medicine, Louisiana State University Health Sciences Center and University Hospital, New Orleans, Louisiana.

Corresponding author: D. Luke Glancy, MD, Section of Cardiology, Department of Medicine, Louisiana State University Health Sciences Center, 1542 Tulane Avenue, Room 441, New Orleans, Louisiana 70112.

LAD (1). The ST segment and the first half of the T wave are essentially normal. At its peak the T wave makes a sharp $>90^\circ$ turn, and its terminal portion is negative (*Figure 1*). This change has come to be known as Wellens' warning. It usually is seen hours or days after myocardial ischemic pain subsides. During pain, T waves are usually upright with ST elevation or ST depression. Depending on the intensity of the ischemia and/or in-

jury, the T waves may return to normal or become deeply, symmetrically inverted (*Figure 2*), the so-called Pardee T waves (2). As the deep inversion resolves over a period of days or months, the pattern of terminal T inversion may be seen again (*Figure 3*).

We also have found this sign to be highly specific for ischemia or injury due to narrowing of the proximal portion of the LAD.

Figure 2. Electrocardiogram on hospital day 3 shows no change in rhythm or QRS morphology, but T waves are deeply and symmetrically inverted in V₁–V₅.

Figure 3. Electrocardiogram on hospital day 4 shows diminished T-wave inversion that again primarily involves the terminal portion of the T wave.

Figure 4. Left coronary arteriograms in the right anterior oblique projection before (left) and after (right) stenting show an 80% narrowing of the origin of the obtuse marginal branch of the left circumflex (arrows). The left descending artery has only a minor narrowing in its midportion.

Figure 5. Electrocardiogram done in the emergency department prior to readmission shows sinus rhythm; a generalized decrease in voltage since the first hospitalization; and Q waves, ST-segment elevation, and T-wave inversion in V₂-V₅ indicating acute anterior infarction.

Figure 6. Left coronary arteriogram in the left lateral projection prior to readmission shows a focal 80% to 90% narrowing of the left descending artery at its origin from the left main artery (arrow). This lesion did not change after administration of nitroglycerin. Angiograms from day 5 of the first hospitalization demonstrated this lesion, although less clearly and again only in the left lateral position.

Although we have rarely seen it with anterior myocardial injury induced by coronary arterial spasm in the absence of an angiographically demonstrable atherosclerotic plaque, in >90% of patients such a plaque will be found if searched for assiduously. That this patient's plaque was seen only in the lateral projection is unusual, as the origin of the LAD usually is best seen in either the right or left anterior oblique projection with caudal angulation of the image intensifier.

1. de Zwaan C, Bar FWHM, Wellens HJJ. Characteristic electrocardiographic pattern indicating a critical stenosis high in left anterior descending coronary artery in patients admitted because of impending myocardial infarction. *Am Heart J* 1982;103:730-736.
2. Pardee HEB. Heart disease and abnormal electrocardiograms, with special reference to the coronary T wave. *Am J Med Sci* 1925;169:270.