Doppler echocardiography is a widely used non-invasive method for the evaluation of coronary flow velocities and reserve. The aim of this report was to demonstrate the possible additive role of transthoracic echocardiography (TTE) in the diagnosis of significant left main coronary artery (LM) stenosis in a patient with chest pain. Coronary angiography showed no significant LM stenosis. During TTE with pulsed-Doppler measurements, a significant increase in coronary flow velocities could be demonstrated in the distal LM. Intravascular ultrasound confirmed a significant soft plaque in the distal LM. The present case suggests that Doppler TTE may have an additional role in the diagnosis of significant LM stenosis in symptomatic patients. A colour Doppler flow acceleration with high velocities in the LM could raise the suspicion of significant LM stenosis, even if the stenosis cannot be detected by standard coronary angiography.

Case presentation

A 52-year-old hypertensive male with 6 months’ history of progressive effort chest pain was referred to the Outpatient Cardiology Clinic of the University of Szeged. No abnormalities could be demonstrated during physical examination or on the 12-lead electrocardiogram. Coronary angiography showed no significant (40%) LM stenosis (Figure 1). During TTE with pulsed-Doppler measurements, a significant increase in coronary flow velocities in the distal LM could be demonstrated (Figure 2). In view of the persistent symptoms and increased coronary flow velocities, a second coronary angiography was performed with the addition of an intravascular ultrasound (IVUS) examination. A significant soft plaque was found in the distal LM (Figure 3A). In our practice, a 6 mm² IVUS lumen area is used as the significant criterion for LM, because it has been shown to correlate with measurements of fractional flow reserve (FFR). Therefore, additional FFR measurement was not performed because the LM measurements satisfied the significant IVUS “cut-off” parameters. Given the significant LM stenosis, an ad hoc percutaneous coronary intervention (PCI) was performed using the standard protocol, with a good result (Figure 3B). After PCI, the patient became asymptomatic and no ST-
A B

Figure 1. Both left (A) and right (B) coronary artery angiograms showed no significant coronary artery stenoses.

A B

Figure 2. Increased coronary flow velocities could be detected by pulsed-wave transthoracic Doppler echocardiography in the distal part of the left main coronary artery (see arrow).

Discussion

The LM has unique anatomical features which limit the visual and angiographic assessment of lesion severity, with relatively large intra- and inter-observer variability. The LM is generally a short vessel and may be diffusely diseased, thus leaving little opportunity for a normal reference segment. The fact that certain parts of the coronary arteries, including the LM, can be visualised with Doppler-TTE has been recognised for several years. In the present case the authors wish to emphasise the importance of Doppler TTE in the evaluation of the significance of LM stenosis in symptomatic patients. The method is simple, non-invasive, easy to learn, and can be used routinely. A colour Doppler flow acceleration with high velocities in the LM could raise the suspicion of significant LM stenosis, even if the stenosis cannot be detected by standard coronary angiography. In case of discrepancies, further examinations can be required (for instance IVUS).

Pulsed-wave Doppler TTE is a reliable method for the evaluation of coronary flow velocity changes.
in the left anterior descending coronary artery (LAD) during vasodilator stress.\textsuperscript{7} Assessment of coronary flow velocity reserve (CFR) in the LAD using TTE is an excellent option for evaluating the functional significance of an LAD stenosis, or coronary microcirculation conditions in the absence of significant LAD stenosis. CFR is usually calculated as the ratio of maximal (hyperaemic) to resting diastolic coronary blood flow velocities. Echocardiography-derived CFR is well correlated with the degree and location of a stenosis.\textsuperscript{7,8} However, it should also be emphasised that CFR is dependent not only on micro- and macrovascular resistance, but also on myocardial resistance, hyperviscosity, metabolic factors, insulin resistance, etc.\textsuperscript{7,9,10}

Apart from wall motion analysis, there are other new echocardiographic techniques that have been used to a limited extent in the diagnosis of coronary artery disease. Contrast echocardiography can be a method of choice in the evaluation of perfusion abnormalities and myocardial flow reserve in certain myocardial regions.\textsuperscript{11} Speckle-tracking strain analysis can also be used for the detection of significant coronary artery disease.\textsuperscript{12}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure3}
\caption{During intravascular ultrasound examination, significant left main coronary artery stenosis could be demonstrated (A), which was treated with a successful percutaneous coronary intervention with stent implantation (B).}
\end{figure}

\begin{tabular}{llll}
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\textbf{A} & & & \\
Pre-PCI status & Ostium & Mid Shaft & Distal shaft \\
Min. lumen diameter & 4.1 mm & 3.5 mm & 2.4 mm \\
Lumen area & 17.4 mm\textsuperscript{2} & 11.5 mm\textsuperscript{2} & 5.5 mm\textsuperscript{2} \\
\hline
\textbf{B} & & & \\
Post-PCI status & Ostium & Mid Shaft & Distal shaft \\
Min. lumen diameter & 5 mm & 3.4 mm & 3.7 mm \\
Lumen and stent area & 18.1 mm\textsuperscript{2} & 9.9 mm\textsuperscript{2} & 9.3 mm\textsuperscript{2} \\
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References


