

## GUEST EDITORIALS

# Novel ultrasonic insight into coronary arteries

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Transesophageal echocardiography (TEE) has gained general acceptance as it provides valuable insights into various clinical situations, can be applied at bedside and in operating rooms, and is relatively inexpensive.<sup>1–4</sup> Besides for the standard cardiovascular examination, TEE has been used to investigate major epicardial coronary arteries in different clinical settings, both with and without the application of Doppler techniques.<sup>4–11</sup>

Most previous TEE studies in coronary arteries concentrated on the assessment of the left main stem—the very proximal left coronary segment—as this is, with TEE, the best assessable segment of the coronary tree.<sup>12</sup> On the other hand, the accuracy of coronary angiographic assessment of lumen narrowing is particularly limited in the left main stem,<sup>13</sup> which makes complementary information on the lumen of this particular coronary segment particularly valuable.<sup>14</sup> In addition, it is well-known that significant left main stenoses have a particularly unfavourable clinical course unless adequately treated,<sup>15–17</sup> and that (on average) the severity of coronary atherosclerosis is conversely proportional to the distance between the coronary site of interest and the aorta-coronary ostium.<sup>12,18</sup> Multiplane TEE permits both, visualization of the coronary arteries far beyond the very proximal segment and reliable identification of coronary artery abnormalities.<sup>8</sup> In a recent study, the technique of fragment reconstruction of coronary arteries from two-dimensional TEE images allowed to obtain summation images of entire coronary vessels, which improved imaging of coronary artery length.<sup>19</sup>

In this issue of the European Journal of Echocardiography, Wild *et al.*<sup>20</sup> report on the application of this technique in patients referred for coronary angiography. As a consequence, they were able to compare images obtained by both techniques. This allowed Wild *et al.* to estimate the clinical potential of the enhanced ultrasonic visualization of extended lengths of coronary arteries. The research group found that with the fragment reconstruction technique, a particular long delineation of the coronary arteries

could be obtained and that the assessment of stenosis severity showed an acceptable concordance with angiography.<sup>20</sup>

Fragment reconstruction of coronary arteries using TEE is a young technique which definitely requires further validation work and the assessment of its reproducibility in various clinical settings and different patient populations. Noticeable is its difficulty in visualizing mid-to-distal segments of left anterior descending coronary arteries.<sup>20</sup> Inherent to this ultrasound-based method is also its limitation in severely calcified vascular segments, where ultrasonic assessment from outside the vessel is unable to reliably visualize the coronary lumen.

Invasive ultrasonic assessment of the coronary arteries by means of intravascular ultrasound (IVUS)<sup>14,21</sup> has the same fundamental limitation; however, as image acquisition is performed from inside the coronary lumen, measurements of coronary lumen dimensions are available even in heavily calcified arterial segments. In coronary segments with no more than moderate calcification, IVUS reliably visualizes the external boundary of the total vessel which permits the assessment of coronary vascular remodelling,<sup>21,22</sup> the relation between plaque progression and cardiovascular risk factors,<sup>23–25</sup> and anti-atherosclerotic medical treatment.<sup>25</sup> Computer processing of the stack of two-dimensional cross-sectional IVUS images permits the reconstruction of longitudinally reconstructed views and even three-dimensional reconstructions.<sup>26,27</sup>

It would certainly be interesting to follow the suggestion of Wild *et al.*<sup>20</sup> to further investigate TEE-based coronary imaging by comparing it with IVUS imaging. Such studies may indicate whether the TEE-based method has the potential to replace IVUS some time for certain indications (e.g. assessment of the significance of left main lesions or serial studies of the progression-regression of coronary atherosclerosis).

Radiation-based non-invasive techniques, such as computed tomography and computed tomographic angiography, have the potential to replace invasive coronary angiography in certain subgroups of patients, while the quality of magnetic resonance imaging of coronary arteries is still limited.<sup>27</sup> Thus, radiation exposure is still an issue and is particularly critical during pregnancy and in patients with massive adiposities. In such cases, reliable non-invasive

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imaging of the coronary arteries during TEE examination may represent an interesting alternative.

In patients with an aberrant origin of a coronary artery, it may be difficult to find and selectively cannulate this vessel during coronary angiography. Non-invasive visualization of coronary vessels with this novel technique could be helpful and may provide additional information on the exact course of the aberrant vessel.<sup>28</sup> Other potential target groups for TEE-based visualization of the coronary arteries may be: patients allergic to dye; patients with renal insufficiency or hyperthyroidism; patients on artificial respiration requiring intensive care; patients with moderate left main lesions during periodic follow-up; and patients treated by PCI of the right coronary ostium or the left main bifurcation during follow-up.

The technique may also be useful intraoperatively<sup>29</sup> and in patients early after coronary bypass surgery, if electrocardiographic signs of ischaemia and/or haemodynamic deterioration request further investigation. If patency of coronary arteries and/or grafts has to be assessed in such patients, it would be most useful to combine morphologic coronary arterial evaluation with a Doppler-based functional assessment.<sup>5,9-11</sup>

Wild *et al.*<sup>20</sup> introduce with their paper an additional player in the clinical arena of non-invasive coronary imaging. Further evaluation of its value in various clinical settings is pending and may be awaited with bated breath.

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