The initial diagnosis and assessment of coronary artery disease (CAD) are important in risk stratification for future cardiovascular events, subsequently leading to an appropriate treatment strategy. How do we diagnose and treat stable patients suspected with CAD? It is not easy to answer appropriately, even for well-trained cardiologists.

Currently, several diagnostic modalities are available for use as tools to establish the initial diagnosis, assess disease severity, and select the appropriate treatment strategy. Each modality has benefits and limitations in various clinical settings. Above all, X-ray coronary angiography (CAG) is the traditional modality for imaging the coronary arteries and remains the gold standard for the diagnosis of CAD. It is able to demonstrate coronary artery stenosis, but cannot inform the composition of atherosclerotic plaque. Though coronary lesions of intermediate severity may cause myocardial ischemia, all coronary lesions are not significant for risk stratification. Coronary revascularization reduces the incidence of death and myocardial infarction in patients with acute coronary syndromes, but similar benefit has not been shown in patients with stable angina. However, stable patients with suspected CAD tend to be taken directly to CAG for the consideration of coronary revascularization. The current diagnostic approach for CAD is broadly based on anatomic and functional imaging, which has shown that the extent of myocardial ischemia and nonviable scarred myocardium are strongly associated with future adverse outcomes. Hence, coronary revascularization should be performed in CAD patients with stress-inducible myocardial ischemia and/or viable myocardium. On clinical assessment and risk stratification, the patients need to be investigated further to confirm the extent of myocardial ischemia and myocardial viability. Noninvasive risk assessment has been more commonly used to determine the need for intensive medical management or coronary revascularization in patients with known or suspected CAD.

Currently, coronary computed tomography angiography (CTA) is able to provide an anatomic assessment for a noninvasive diagnosis of coronary artery stenosis. It also permits direct visualization of coronary atherosclerotic features, including plaque composition, compared with the conventional CAG. The characteristics of coronary CTA are associated with the development of subsequent acute coronary syndromes, including positive vascular remodeling, low plaque density, and spotty calcification. The coronary calcium score can value subclinical atherosclerosis by assessing the atherosclerotic plaque burden. Although CT calcium scoring allows identification of asymptomatic plaque burden, population-wide screening is currently not yet recommended. Coronary CTA itself does not determine whether a stenotic lesion causes myocardial ischemia. Very recently, noninvasive fractional flow reserve derived from coronary CTA has high diagnostic performance for the detection and exclusion of coronary lesions that cause myocardial ischemia. Coronary CTA might provide an assessment of CAD severity and incremental prognostic information beyond the evaluation of traditional risk factors and the CT calcium score.

In contrast, cardiac nuclear imaging has a great advantage because of its capability to obtain physiological information on luminal stenosis such as myocardial perfusion, which is difficult to verify by other techniques. Among the diagnostic tests, myocardial perfusion imaging (MPI) is a well-established modality for assessing myocardial ischemia, myocardial viability, cardiac risk stratification, and the efficacy of coronary revascularization in patients with known or suspected CAD. Rest MPI can provide important information such as myocardial viability. The functional assessment of coronary artery stenosis can be assessed by stress MPI. Because the presence of stress-induced myocardial ischemia is associated with a high risk of future cardiac events, stress MPI plays a crucial role in coronary revascularization decision-making of whether the invasive procedure is necessary or not.

To date, clinical outcomes after MPI, coronary CTA, and CAG in patients with suspected CAD have not been fully examined. In this issue of the Journal, Yamauchi et al and the Japanese Coronary-Angiography or Myocardial Imaging for Angina Pectoris Study (J-COMPASS) Multicenter Study Group evaluate optimal initial diagnostic strategies for the assessment of CAD patients. Their prospective observational study demonstrated that the risk of major adverse cardiac events (MACE) in the MPI and CT groups was similar and significantly less than that in the CAG group when adjusted for confounding factors, including CAD severity. Furthermore, the rate of revascularization in the MPI group was less than that in either the CTA or CAG group (Figure).

With respect to cost effectiveness and radiation burden, coronary CTA would have the lowest total costs and total estimated effective radiation dose each scan. However, it has some limitations regarding the use of iodinated contrast media,
which is a risk for hypersensitivity reactions and the development of contrast-induced nephropathy. Furthermore, there are unsatisfactory assessments under calcified lesions. Nuclear imaging does not require contrast agents, so most patients are able to have this test even if they are sensitive to contrast agent or have renal dysfunction. The major limitation of MPI is the relative high false-positive rate, which is attributed to soft tissue attenuation artifacts, particularly in females and in obese patients. In regard to the diagnostic accuracy of MPI for CAD, a pooled analysis of 79 studies including 8,946 patients reported that average sensitivity and specificity were 86% and 74%, respectively. Incorporating ECG-gated imaging can improve the diagnostic accuracy and it is now used routinely in many centers. Combined ECG-gated SPECT imaging and perfusion imaging can detect the distinction between a true perfusion abnormality and artifact. Besides, the limitation is being progressively reduced by positron emission tomography with the advance in absolute myocardial flow quantification.

With the increasing number of patients referred for evaluation of the presence and extent of CAD, imaging techniques have become very important in clinical management. It is currently unclear whether these modalities demonstrate clinical value in stable patients suspected with CAD as the initial diagnosis. Yamauchi et al demonstrate that ischemia-guided diagnosis with MPI, particularly in stable patients suspected with CAD, decreases the risk of MACE and coronary revascularization.

References