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## Cardiovascular Imaging in Special Patient Populations



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Cardiovascular disease remains a major worldwide public health problem and despite significant advances in diagnosis and treatment, coronary artery disease represents the leading cause of death in the developed world. In some specific patient populations, such as including subjects with asymptomatic CAD, diabetes mellitus, obesity, and kidney or liver disease, which are indicated as CAD equivalent populations, accurate screening is necessary to identify CAD or those patients at high risk of cardiovascular events.

### Key points

- Cardiovascular disease represents a major worldwide public health problem and despite significant advances in diagnosis and treatment, coronary artery disease (CAD) remains the leading cause of death in the developed world.
- In some specific patient populations, such as including subjects with asymptomatic CAD, diabetes mellitus, obesity, and kidney or liver disease screening is necessary to identify those patients at high risk of cardiovascular events .
- Stress SPECT MPI is able to provide accurate quantification of the extent and severity of fixed and reversible perfusion defects, with high diagnostic and prognostic impact.

### Myocardial Perfusion Imaging in Specific Patient Populations

Cardiovascular disease remains a major worldwide public health problem and despite significant advances in diagnosis and treatment, coronary artery disease (CAD) represents the leading cause of death in the developed world.

Risk assessment in patients with suspected CAD is a useful process to identify those at higher risk of disease who require a more aggressive diagnostic and therapeutic approach to prevent adverse events at follow-up (Knuuti J et al. 2020 ). In some specific patient populations, such as including subjects with asymptomatic CAD, diabetes mellitus (DM), obesity, and kidney or liver disease, which are indicated as CAD equivalent populations, accurate screening is necessary to identify CAD or those patients at high risk of cardiovascular events.

The screening test should be accurate, reliable, and should be able to provide results with high reproducibility.

Patients with diabetes show an excess of death from cardiovascular causes, twice as high as the general population, probably due to an association with other cardiovascular risk factors such as dyslipidaemia, obesity and hypertension. In addition, in diabetic patients both microvasculature and macrovasculature pathology contributes to the higher risk of cardiovascular disease. Early detection of the effect of diabetes on the cardiovascular system represents a critical point and could improve preventive measures and initiation of treatments with proven cardiovascular benefit.

Among non-invasive imaging modalities radionuclide myocardial perfusion imaging (MPI) by single photon emission computed tomography (SPECT) or positron emission tomography (PET) are the most used for the evaluation of patients with suspected or known CAD.

SPECT MPI is performed after injection of a radiotracer such as  $^{99m}\text{Tc}$ -sestamibi and  $^{99m}\text{Tc}$ -tetrofosmina, which are taken up by the myocardial cell through the bloodstream. The test can evaluate myocardial perfusion both in basal conditions of rest and during physical exercise or

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pharmacological stress with dipyridamole, adenosine or dobutamine.

Stress MPI is able to provide information on the extent and severity of a perfusion defect associated to the evaluation of left ventricular function, with high reproducibility and diagnostic and prognostic impact (Acampa W et al. 2013).

The results obtained by SPECT MPI are carefully correlated with the functional significance of the coronary arteries disease state and consequently to cardiovascular event risk. In particular, the presence of moderate to large percentage of myocardial induced ischemia is predictor of higher probability of cardiac events, suggesting the need to address those patients for a revascularization procedure, with a better survival benefit as compared to medical therapy.

The European Society of Cardiology guidelines suggest that in asymptomatic adults with DM or asymptomatic adults with a strong family history of CAD or when previous risk assessment testing suggests a high risk of CAD, stress MPI *may be* considered for cardiovascular risk assessment.

Chronic kidney and liver disease also represent major risk factors for cardiovascular disease. Patients with chronic kidney disease (CKD) are at higher risk of cardiovascular mortality compared with the age- and sex-adjusted general population with normal kidney function.

The risk of CAD and mortality is also correlated with the degree of renal dysfunction. In patients who are candidates for kidney and liver transplantation, and also after renal or liver transplantation, cardiovascular disease remains a leading cause of mortality and morbidity.

In both special populations the association of many traditional risk factors such as age, DM, dyslipidaemia and hypertension have a significant role to increase cardiovascular risk. Moreover, the presence of non-traditional risk factors related to transplant therapy may have an impact on CAD disease. In these patients, it is relevant and necessary to assess prior to transplantation surgery all specific risk factor which may have an influence on the risk of CAD.

This precaution is necessary both to prevent cardiac events and also to obtain an optimal risk stratification.

There was no consensus on the best diagnostic strategy in these patients with kidney or liver disease, however the use of non-invasive cardiovascular testing is recommended in patients with two or more risk factors to accurately identify patients who are poor candidates for transplantation and to address patients with severe CAD to a more aggressive treatment as revascularization procedure prior to transplantation (Doukky R et al. 2018).

Stress MPI, with both exercise or vasodilator stress agents, represents the most commonly performed study in patients with CKD, with good sensitivity and specificity and a strong prognostic value, and with a high correlation between the presence of abnormal results and poor outcome at follow-up.

In patients with chronic liver disease, although routine screening of CAD is recommended, there are only limited data on the overall efficiency and cost-effectiveness of preoperative assessment with SPECT MPI in patients undergoing liver transplantation and further studies are necessary (Bradley SM et al. 2010).

In this category of patients non-invasive coronary computed tomography (CT) angiography (CCTA) may represent the preferred imaging modality considering that it has >99% negative predictive value in "ruling out" CAD in different clinical contexts.

## **Conclusion**

Cardiovascular disease is the most common co-morbidity and represents a major cause of mortality in diabetic patients and in patients with chronic kidney and liver disease.

SPECT MPI is widely used in the evaluation of myocardial perfusion with the advantage of providing information about left ventricular perfusion and function. Further studies are needed to better define the best cardiovascular diagnostic strategy in patients with kidney or liver disease.

## **Conflict of Interest**

None.

