Investigations

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Non-invasive methods of diagnosis Resting electrocardiography As a baseline test, a 12-lead resting electrocardiogram (ECG) often provides the first indication of ischaemic cardiac disease and is essential in the acute clinical setting. However, it may be normal even in the presence of severe multivessel coronary disease. Evidence of previous myocardial infarction (MI) is indicated by Q waves and/or non-specific ST- and T-wave changes and angina by ST depression. Troponin and cardiac isoenzymes These are useful in assessing patients with an acute coronary syndrome (ACS), which is the umbrella term for STEMI (ST elevated myocardial infarction), non-STEMI and unstable angina, especially when the diagnosis is in doubt. Standard enzyme measurement such as troponin, creatine kinase myocardial band and lactate dehydrogenase can also aid both diagnosis and prognosis. Exercise tolerance testing (ETT) is a valuable technique for assessing myocardial ischaemia, both for diagnostic purposes - and as a prognostic tool. However, an abnormal exercise test must be interpreted in the light of the probability of CAD and the physiological response to exercise as measured by the percentage of the maximum predicted heart rate achieved. A positive test with evidence of ischaemia on the ECG (ST depression of ≤ 2 /uni00A0 mm) does not always indicate IHD, and a negative test does not always exclude its presence. ETT should be avoided in patients with cardiac disorders such as aortic - stenosis. Echocardiography Performed through either a transthoracic or transoesophageal approach, echocardiography is valuable for the evaluation of ventricular function and regional wall motion, as well as valvular lesions. Transoesophageal echocardiography provides essential real-time information intraoperatively . Stress echocardiography can detect regional wall motion abnormalities brought on by exercise or the use of dobuta - mine or dipyridamole. It is reliable in identifying viable myo - cardium. Impaired but recoverable myocardium possesses a - functional reserve that allows it to be temporarily recruited into action, whereas scar tissue does not. The development of real- time three-dimensional echocardiograph y (RT3DE) with the ability to carry out valve reconstruction from di ff erent aspects has recently revolutionised preoperative surgical planning in patients with complex valvular lesions. Radionuclide studies and cardiac magnetic resonance imaging The main type of radionuclide study used is myocardial perfusion scanning using specific radioisotopes (such as thal - lium-201) to assess the significance of coronary disease and viability of the myocardium. Cardiac magnetic resonance imaging (MRI) can be per - formed to ev aluate the ischaemic burden of coronary disease (using pharmacological agents to stress the heart) and to provide details of tissue viability when using gadolinium as a contrast agent. Close gap MRI is also very useful in assessing cardiac tumours, pericarditis and other structural heart diseases. Positron emission tomography Positron emission tomography (PET) provides information on myocardial perfusion, metabolism and cell membrane func - tion. Positron-emitting isotopes are used to label physiological substances, which can measure the regional distribution of these substances. PET is valuable in the diagnosis of CAD, particularly when the more widely available imaging modalities are inconclusive. It can identify injured but viable myocardium that is potentially salvageable by revascularisation. Computed tomography With the development of ECG-gated computed tomography (CT) scanners,

multislice high-resolution CT imaging may become an alternative to coronary angiography . It allows assessment of coronary disease, particularly proximal CAD, and gives some information about the degree of coronary artery calcification (calcium score) that is very helpful when stratifying patients to determine which ones will benefit from more invasive coronary angiography . It is also useful in patients in whom angiography is challenging (e.g. di ffi cult anatomy). Invasive methods of diagnosis Coronary angiography Selective coronary angiography remains the gold standard diagnostic technique for accurate diagnosis of the presence and extent of CAD (Figure 59.3). In spite of the availability of newer imaging techniques such as cardiac MRI, selective coronary angiography provides high image quality , demonstrating the extent, severity and location of coronary artery stenoses and the quality and size of the distal coronary arteries. Di ff erent categories of coronary disease are shown in Table 59.1 addition, angiography can assess ventricular function and provide the cardiac surgeon with information to determine operability , operative risk and probability of success. Coronary angiography only outlines the coronary anat omy; it does not demonstrate ischaemia and it carries an overall complication rate of less than 1%. However, flow measurement across a stenotic area, using techniques such as fractional flow reserve, has been e ff ectiv e in predicting those patients who are likely to benefit from revascularisation. Moreover, intravascu lar ultrasound can provide more detailed information regard ing the degree of stenosis, especially in left main stem disease. A reduction in the luminal diameter of ≥ 70% usually means an inability to increase coronary flow above resting values. Coronary angiography /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Figure 59.3 Coronary angiogram demonstrating severe stenosis in the left main stem prior to bifurcation of the left anterior descending and circum /f_l ex arteries. The arrow indicates the area of severe stenosis. TABLE 59.1 Luminal stenosis of coronary arteries and angiographic /f_i ndings. Minimal Mild Angiographic degree of 0% 20–49% stenosis Luminal cross-sectional 0% 40–60% stenosis Gold standard for imaging coronary anatomy Demonstrates extent, severity and location of stenosis Demonstrates quality and size of distal arterial tree Aids diagnosis of ischaemia Evaluates suitability for surgery Aids in prognostic assessment

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