Introduction

National Institute for Clinical Excellence (NICE) recommendations on the use of myocardial perfusion scintigraphy were published in November 2003 but there is still much that needs to be done in the UK before they enjoy wide implementation.

To help move towards better implementation of this guidance, a meeting was held recently at the National Heart and Lung Institute, London, to discuss what clinicians can do in this field of non-invasive imaging. The NICE final appraisal determination for myocardial perfusion scintigraphy (MPS) for the diagnosis and management of angina and myocardial infarction had a number of recommendations:

- MPS should be the initial diagnostic tool in people for whom stress echocardiography poses particular problems, such as difficulties in interpretation. NICE included here people with cardiac conduction abnormalities, people unable to exercise, women and diabetic patients. While there is little debate about the first two inclusions, the last two groups may strike some clinicians as overenthusiastic.
- MPS should be part of an investigational strategy for people with a "lower likelihood" of coronary artery disease (CAD) and future cardiac events. This "lower likelihood" was not defined further, however, neither was CAD risk divided into low, medium and high, as is frequently seen in consultation documents and guidelines.
- MPS should be part of the investigational strategy in symptomatic patients after myocardial infarction or revascularisation.

The meeting gathered experts (see box on contents 2) from the fields of cardiac imaging, nuclear medicine, cardiology, radiology, health economics and primary care. Their presentations were wide-ranging, covering the clinical rationale for MPS versus other modalities, its cost-effectiveness, how MPS is used in the UK and how this can be expanded, including an action plan for Primary Care Trusts. This supplement contains highlights from these presentations, and also reports on the ensuing round-table discussion.

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The use of myocardial perfusion scintigraphy in coronary artery disease

Myocardial perfusion scintigraphy (MPS) is the standard clinical technique for assessing myocardial perfusion and hence coronary function. A comparison of images after stress and rest injection of tracer provides a simultaneous assessment of myocardial viability, perfusion and function. In patients with suspected coronary disease, MPS can be used to assess whether coronary obstruction is present and, if so, to what extent. In patients with known coronary disease, it can be used to guide revascularisation and to assess its adequacy, and to determine the likelihood of further events.

Stressing myocardial perfusion

Dynamic exercise using a treadmill or bicycle ergometer can be used to stress myocardial perfusion provided that the patient can exercise to 85% of the maximum predicted heart rate. Pharmacological agents are an excellent alternative, particularly in patients who cannot exercise adequately. The vasodilators adenosine and dipyridamole are given by intravenous (IV) infusion, and this can be coupled with submaximal dynamic exercise to reduce side effects and to increase myocardial uptake compared with neighbouring tissues. Vasodilator stress is contra-indicated in patients with asthma or heart block but in these cases the inotropic agent dobutamine is an alternative.

Radiopharmaceuticals

Three tracers are commercially available in the UK—thallium-201, technetium-99m sestamibi and technetium-99m tetrofosmin. After IV injection these agents are distributed within the myocardium according to its viability and perfusion. The technetium-99 tracers allows ECG gating, which helps to overcome artefact and provides additional functional information. In the recent ROBUST study of 2,650 patients, there was no significant difference between the tracers in sensitivity and specificity.

The standard imaging technique is single photon emission computed tomography (SPECT). The gamma camera used to obtain myocardial images rotates around the patient for 10-20 minutes and the data are processed into tomographic images.

There are various imaging protocols, such as one day stress-rest, one day rest-stress and two day (especially in obese patients). The two-day protocol is less convenient for patients but can provide the best images.

Interpretation of the findings

A reduction in tracer uptake that does not change between rest and stress images, a "fixed perfusion abnormality", normally indicates a myocardial infarction. The degree of reduction indicates the thickness of the infarct.

An improvement in tracer uptake from stress image to rest image, an "inducible perfusion abnormality", often indicates inducible ischaemia in that part of the myocardium. The difference between stress and rest images indicates the severity of the inducible ischaemia.

The clinical rationale for myocardial perfusion scintigraphy

CONSTANTINOS ANAGNOSTOPOULOS

Introduction

The usefulness of myocardial perfusion scintigraphy (MPS) in the diagnosis of coronary artery disease (CAD) was confirmed in a recent meta-analysis (Loong CY, Anagnostopoulos C. *Heart* 2004;**90**[suppl 5]:v2-9). A total of 79 studies involving 8,964 patients found 86% sensitivity and 74% specificity for this technique. Importantly, the normalcy rate (the rate of normal perfusion scans in patients with a low likelihood of CAD) was 89%. Thus the message has been reinforced that MPS is a good tool both in identifying significant disease and in excluding it. Clinicians may reasonably decide that patients who have a normal MPS scan do not need more invasive investigations.

Key messages

- Patients with normal MPS scans do not need to proceed to invasive investigations
- MPS can provide prognostic information in coronary artery disease and act as a gatekeeper to future services such as angiography
- MPS provides incremental prognostic information over and above that given by clinical and exercise ECG data

The prognostic value of MPS

MPS is effective in providing prognostic data in CAD. Among 20,963 patients from 29 studies who were followed up for a mean of 28 months, the annual hard event rate was 0.7% for those with a normal MPS scan compared to 4.7% for those with an abnormal MPS scan. Similarly, in a study of 1,926 patients with stable angina who were followed up for a mean of 33 months, the number of perfusion defects and cardiac mortality were correlated. While there was an annual cardiac mortality of 0% in patients without perfusion defects, there was a 17% annual cardiac mortality in those with more than three defects.

In a different study (see figure 1) with a total of 5,183 patients, those with a normal MPS scan had a cardiac death rate of 0.3% and a myocardial infarction (MI) rate of 0.5%, whereas this rose to rates of 2.9% and 4.2%, respectively, with a severely abnormal scan. This gives support to the idea of using myocardial perfusion imaging as a gatekeeper to future services: patients with severely abnormal scans should be referred to coronary angiography.

Assessment of myocardial perfusion and function using ECG-gated single photon emission computed tomography (SPECT) adds prognostic information over and above that provided by conventional clinical, electrocardiographic and angiographic data. Reversible perfusion abnormalities are commonly associated with an increased likelihood of ischaemia complications, and a higher risk of death is observed in patients with large fixed defects. The use of summed scores obtained from segmental models of the left ventricular myocardium has become popular. The highest annual event rates (4.2% for MI and 2.9% for death) were observed among patients with a high summed stress score in one recent study; by contrast, patients with a low summed stress score had a 0.8% annual risk of cardiac death and a 2.7% annual risk of non-fatal MI.

Left ventricular ejection fraction (LVEF) is the parameter most commonly used to measure ventricular function. LVEF as measured by radionuclide techniques provides an independent estimate of the risk of cardiac death. Other useful functional parameters that indicate a poor prognosis include transient dilatation of the left ventricular cavity and increased lung uptake on stress thallium images.

The INSPIRE trial

More information on the prognostic use of MPS in stable post-MI patients will be available later this year with publication of the INSPIRE (Adenosine Sestamibi Post-Infarction Evaluation) trial. In the study, several hundred patients were given an initial technetium-99m sestamibi MPS scan 2-5 days post-MI and then allocated to various risk categories according to their perfusion defect size, amount of ischaemia and left ventricular ejection fraction. High-risk patients were randomised to different management strategies (including intensive medical treatment, revascularisation and coronary artery bypass grafting [CABG]). A sec-

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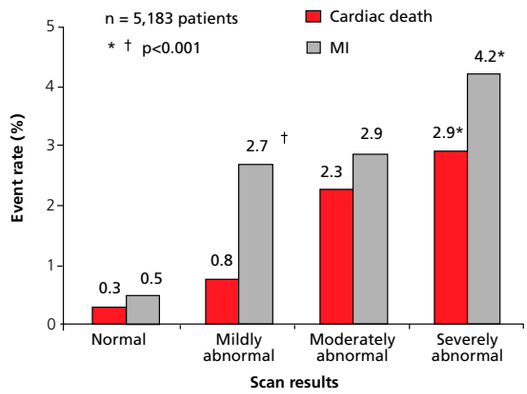
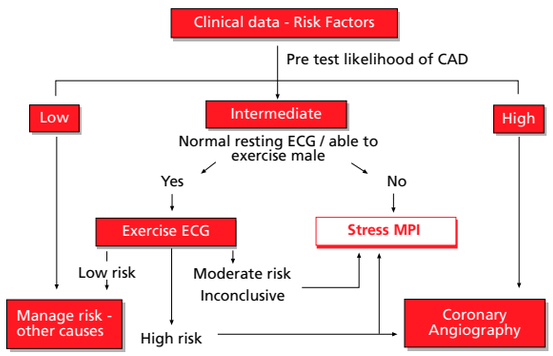
Figure 1. Prognostic value of MPS



Adapted from: Hachamovitch R *et al*. *Circulation* 1998;**97**:535

Figure 2. Assessment of chronic chest pain algorithm



Adapted from: Investigation of stable angina. BCS & RCP Guidelines. *Heart* 1999;**81**:5-6-55

Table 1. Indications for scintigraphy in the ACC/AHA/ASNC guidelines

- To identify the extent, severity and location of ischaemia in patients with an abnormal resting ECG
- 3-5 years after revascularisation in asymptomatic patients
- To assess the functional significance of intermediate coronary lesions
- In patients with an intermediate Duke treadmill score
- Repeat imaging when symptoms have changed, to redefine the risk of cardiac events

ond SPECT scan was performed at 6-12 weeks to assess the change in total ischaemic perfusion defect size from baseline. Patients were then followed up for one year for the occurrence of major adverse cardiac events.

Other guidelines

A number of guideline documents and statements have been issued on the use of MPS. Table 1 shows class 1 indications for MPS in the American College of Cardiology (ACC)/American Heart Association (AHA)/American Society of Nuclear Cardiology (ASNC) guidelines. Figure 2 shows an algorithm for the investigation of stable angina recommended by the British Cardiac Society and the Royal College of Physicians.

Round table discussion

● Spreading the benefits

The data on the prognostic ability of MPS impressed the National Institute for Clinical Excellence (NICE) but the panel felt that many doctors were still unaware of the benefits of MPS. Although the evidence suggests that people with suspected CAD but whose perfusion scan is normal do not need further investigations, many clinicians still want further evidence of this from an angiogram.

● MPS versus angiography

One of the main problems to overcome is that the decision to revascularise will usually be made on the basis of the angiography findings. Data on the prognostic power of MPS, although convincing, are mostly retrospective. Prospective randomised trials are needed to show that the population benefits from a strategy of perfusion imaging and intervention in those with extensive ischaemia.

● Patient take-home messages post-MPS

A significant take-home message for patients who have a normal MPS scan is that they are unlikely to suffer a significant myocardial event in the next two years.

● Influencing local pathways

In order to influence behaviour and implement pathways locally, it is important to have strong clinical champions. Doctors must be encouraged not only to understand the technology but also to use it. Junior doctors who are taught the benefits of nuclear cardiology will go on to seed enthusiasm elsewhere. Currently specialist registrars in cardiology do not have much experience in nuclear cardiology or they may not stay long enough in one department to get a feeling of continuity. They need to see that nuclear scan results are really helpful and that they match with the angiography findings in the majority of cases.

Myocardial perfusion scintigraphy – the NICE appraisal

S RICHARD UNDERWOOD

Introduction

The National Institute for Clinical Excellence (NICE) recent technology appraisal for the use of myocardial perfusion scintigraphy (MPS) in the diagnosis and management of angina and myocardial infarction looked at evidence from a variety of sources. The initial assessment gathered and synthesised evidence, assessing its strength and consistency, and looked at cost-effectiveness models of the technique. The subsequent, largely subjective, appraisal consisted in judging the applicability of both the evidence and the models used, and determining appropriate NHS policy.

The NICE recommendations and scope of guidance

The final appraisal determination of NICE is summarised in table 1 and its scope is shown in table 2.

MPS has 86% sensitivity, 74% specificity and 89% normalcy rates in the diagnosis of coronary artery disease (CAD). A meta-analysis of 29 studies involving 20,963 patients with CAD showed those with a normal MPS scan had a 0.7% annual hard event rate whereas those with an abnormal scan had a 6.7% annual hard event rate.

The EMPIRE (Economics of Myocardial Perfusion Imaging in Europe) study provided valuable information on the cost of strategies for management of cardiovascular symptoms. Patients with stable chest pain syndromes presenting to centres in four European countries that either routinely used MPS or routinely did not use MPS were included in the analysis. Four strategies of investigation were compared: exercise electrocardiogram (ECG) and angiography; exercise ECG, MPS and angiography; MPS and angiography; and angiography alone. Both in terms of cost of diagnosis and overall two-year management (but not in patient outcome), diagnostic strategies using MPS were cheaper than, and as effective as, those that did not use it.

Local implementation recommended

NICE recommendations for implementation of its guidance were all local measures:

- NHS hospitals and clinicians should take account of the guidance
- local guidelines or care pathways should incorporate the guidance
- to measure compliance, suggestions for local audit are provided.

There was no suggestion of centralisation.

British Nuclear Cardiology Society (BNCS) data suggest that use of MPS in the UK is growing very rapidly, with a linear compound growth rate of 12.5% per annum and somewhere between 1,400 and 1,900 scans per million population per annum (figure 1). Despite this rate of growth, the UK is still slightly behind other countries in Europe.

Targets for service provision supported by NICE are considerably greater than current practice. The profession recommends a target volume of 4,000 scans per million per year and target waiting times of six weeks for routine cases and a one week maximum wait for urgent cases. The current volume is 1,200 scans per million per year, with an average waiting time of 20 weeks. Service implications for meeting these targets are shown in table 3. They imply a significant lag time, perhaps 10 years, to achieve the goal of adequate and good-quality service provision.

Interestingly, a comparison of investigation rates in the US and the UK shows that MPS is used more often as gatekeeper to angiography in North America, whereas in the UK there is a greater use of angiography. American figures for 1996 give a MPS:angiography: revascularisation ratio of 2.5:1.4:1 whereas the equivalent UK figures are 1:2.2:1. These ratios suggest dif-

Key messages

- Implementation of the NICE guidance should be at a local level
- The rate of growth of MPS is increasing in the UK but it is still behind continental Europe
- Target volume for MPS is 4,000 scans per million per year with a routine 6-week wait (1 week for urgent cases)
- NICE guidance is to be reviewed at the end of 2006

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Table 1. The NICE recommendations for MPS

Myocardial perfusion scintigraphy (MPS) using SPECT (single photon emission computed tomography) is recommended for the diagnosis of suspected coronary artery disease (CAD) in the following circumstances:

- As the initial diagnostic tool in people for whom stress ECG poses particular problems, including
  - cardiac conduction abnormalities
  - those unable to exercise
  - women
  - diabetic patients
- As part of an investigational strategy for people with a lower likelihood of CAD
- As part of the investigational strategy in symptomatic patients after myocardial infarction or revascularisation

Table 2. Scope of the NICE guidance

Objective
- To assess the clinical and cost-effectiveness of MPS for the diagnosis and management of suspected angina and myocardial infarction
- To provide guidance to the NHS in England and Wales

Comparators
- Strategies for diagnosis and management with and without MPS
- Current strategies include exercise ECG and angiography
- Echocardiography, magnetic resonance imaging (MRI) and positron emission tomography (PET) were not considered

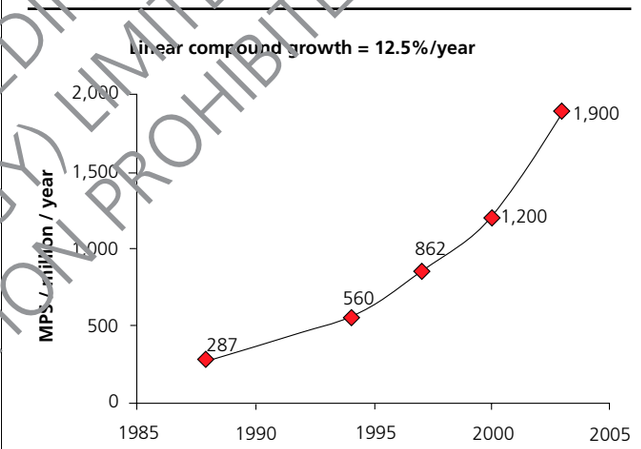
Other considerations
- Myocardial viability was not examined
- No comparisons were made between perfusion agents
- Attempted to identify subgroups where MPS is particularly appropriate e.g. women, post-MI
- Use of MPS in the context of rapid access chest pain clinics was considered
- Service implications, training needs and waiting times were considered

Table 3. UK service implications for meeting NICE guidance

To increase myocardial perfusion scintigraphy scans to 4,000 per million per year with an average waiting time of 6 weeks for routine cases (1 week for urgent cases):

- Capital requirement to purchase 84 cameras of £21 million
- Revenue requirement of £31 million per year
- New staff
  - 168 radiographers
  - 84 nurses
  - 42 physicists
  - 45 physicians
- Major problem
  - Recruitment and training
  - Goal not achievable before 10 years

Figure 1. British Nuclear Cardiology Society surveys showing the growth in myocardial perfusion scintigraphy (MPS)



ferent interpretation of techniques and different investigational pathways on the two sides of the Atlantic.

NICE outcomes so far

The NICE guidance will be reviewed in November 2006. A number of publications have detailed the evidence for MPS and have given guidance for setting up a nuclear cardiology service (see key reviews). Guidance has been disseminated among the medical profession, and there is now increased demand for MPS.

The Department of Health has published its own target of 13 weeks as the maximum wait for scintigraphy for non-urgent cases (reducing to six weeks by 2008). Imaging companies have produced their own evidence summary and cost-effectiveness analysis; they have also provided a mobile nuclear cardiology service and are talking about assistance with managed MPS services.

Possible further outcomes to be addressed include: a £20 million capital fund over the next five years, a coordinated approach to revenue costs, a policy for staff recruitment and training, standards for training and quality assurance, consideration of MPS alongside other imaging techniques such as stress echocardiography, and incorporation of MPS into the next National Service Framework for CHD update.

Round table discussion

To ensure MPS is included in future service provision, the panel felt that there is a need for a top-down approach to MPS. Business plans and models should be formulated. Strategic Health Authorities and cardiac networks should be involved and working groups should devise a model for national distribution and rollout. This would give rationalised governance indications and risk assessments.

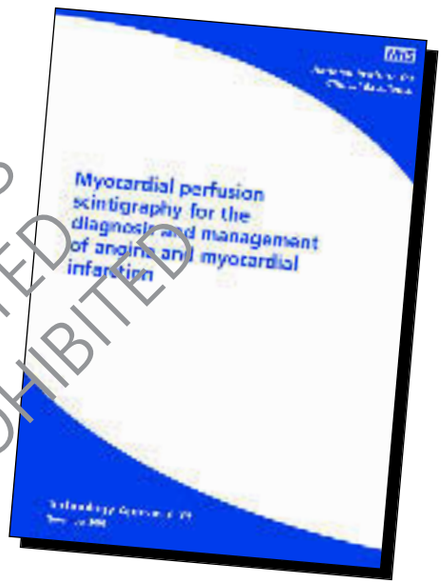
- **Local implementation**

Any central advice would be locally implemented. Proposed new management pathways must link into the local services that have been designed to encourage its use by clinicians.

- **The involvement of cardiac networks**

The new cardiac networks were seen as being very influential in influencing behaviour and they need to be given useful data on MPS and convinced of its benefits. Since waiting lists are currently a major focus in the NHS, a model that reduces waiting lists, for example, is likely to meet with approval.

Key reviews giving guidance on how to set up a nuclear cardiology service



1. Underwood R. Myocardial perfusion scintigraphy: the evidence. *Eur J Nuc Med* 2004; **31**: 261-91.

2. Anagnostopoulos C, Underwood R on behalf of the British Nuclear Cardiology Society. Myocardial perfusion scintigraphy: the evidence. *Heart* 2004; **90** (suppl V): v1-v40.

3. Anagnostopoulos C, Harbinson M, Kelion A *et al*. Procedure guidelines for radionuclide myocardial perfusion imaging. *Heart* 2004; **90** (suppl I): i1-i10.

4. Anagnostopoulos C, Davies G, Flint J *et al*. Setting up a Myocardial Perfusion Scintigraphy service: clinical and business aspects. *Heart* 2005; (in press).

5. National Institute for Clinical Excellence. Myocardial perfusion scintigraphy for the diagnosis and management of angina and myocardial infarction. London: National Institute for Clinical Excellence, Technology Appraisal 74, November 2003. www.nice.org.uk

Cost-effectiveness of myocardial perfusion scintigraphy SPECT versus other modalities

LESLEE SHAW

Introduction

Cost-effectiveness provides a rational means to allocate limited resources. To determine the cost-effectiveness of myocardial perfusion scintigraphy (MPS), the costs of coronary heart disease (CHD), imaging and the clinical effectiveness of imaging in addressing CHD need to be assessed. The economic burden of CHD is considerable: estimated costs of CHD in the UK in 1999 were £1.73 billion, rising to £7.06 billion when the costs of low productivity and informal care are added. In total, CHD accounts for 5% of hospitalisation costs for men and 2% of hospitalisation costs for women, and prescription costs for lipid-lowering and antihypertensive drugs rose by £171 million between 2000 and 2001.

For diagnostic tests, cost-effectiveness has to be redefined. Survival is not directly impacted by tests, but the results are used to initiate life-saving treatments or procedures. Thus, tests have an indirect benefit on survival, and this is difficult to calculate. In the UK myocardial perfusion scintigraphy (MPS) is used much less than in other countries (see figure 1).

The principles of cost-effective diagnosis and management of coronary artery disease (CAD) using MPS are shown in table 1. A variety of studies have been analysed in economic evaluations in the area of MPS. Most of these used investigations sequentially (for example, clinical examination followed by ECG [electrocardiography] followed by SPECT [single photon emission computed tomography], or ECG followed by SPECT followed by angiography). The theoretical concepts leveraging the incremental cost-effectiveness ratio of MPS are that improved accuracy drives both clinical and cost-effectiveness. Lower cost and equivalent accuracy drive quality care and cost-effectiveness.

The EMPIRE study

The EMPIRE (Economics of Myocardial Perfusion Imaging in Europe) study showed the cost-effectiveness of MPS. It compared the two-year costs of diagnosis and management of CHD in patients presenting with stable chest pain syndromes to centres that routinely use MPS and to those that do not in four European countries (figure 2). This study and two other large series have shown that there are substantial cost savings – about 30% – with use of a selective angiographic approach in the setting of demonstrable ischaemia. The economic burden of a myocardial infarction (MI) is very high, so any test that can help to identify its occurrence in a large proportion of patients will clearly be cost-effective.

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Key messages

- Imaging is generally more accurate and cost-effective than electrocardiography or (in some cases) laboratory markers
- Improved accuracy drives clinical and cost effectiveness
- Extent and severity of perfusion abnormalities drive risk assessment and expected cost (resource intensity)
- Imaging can save money when applied to lower risk, stable populations
- Lower cost and equivalent accuracy drive quality care and cost-effectiveness

Cost-effectiveness in special populations

A recent American Heart Association (AHA) imaging statement said that both echocardiography and SPECT were highly effective in risk stratification, with a better incremental cost-effectiveness ratio (ICER) compared to exercise ECG and angiography in intermediate-risk women. A study looking at the diagnostic and two-year costs of care in women with stable angina is shown in figure 3.

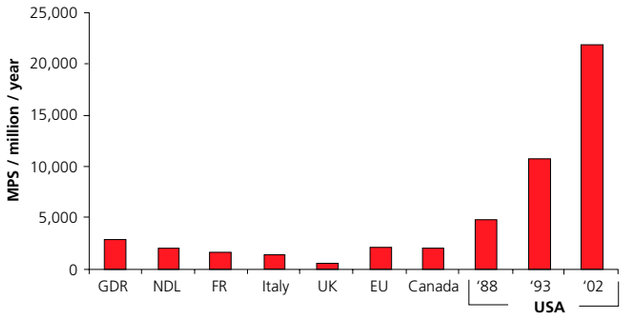
The AHA statement also said that in acute coronary syndromes (ACS), use of SPECT saved treatment costs over a 12-month follow-up period. In acute MI, both stress ECG and selective SPECT plus angiography were cost-effective.

NICE economic conclusions

The National Institute for Clinical Excellence (NICE) appraisal of MPS concluded:

1. Direct angiography is cost-effective when the prevalence of

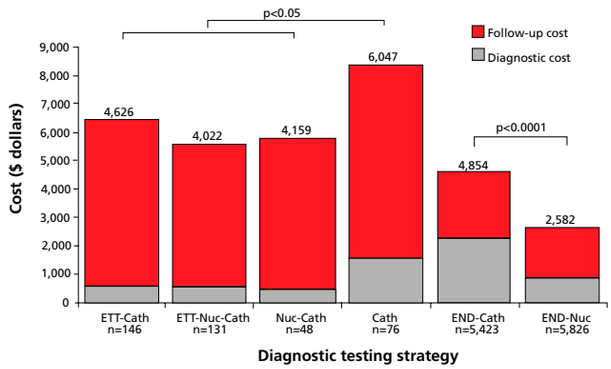
Figure 1. Myocardial perfusion scintigraphy (MPS) rates in Europe and North America



Key: GDR = Germany, NDL = The Netherlands, FR = France, EU = European Union

Adapted from: Underwood, Anagnostopoulos, Cerqueira, Ell, Flint, Harbinson, Kelion, Al Mohammad, Prvulovich, Shaw, Tweddel. Myocardial Perfusion Scintigraphy – the Evidence, a consensus conference by British Cardiac Society, British Nuclear Cardiology Society, & British Nuclear Medicine Society. *Eur J Nuc Med and Molecular Imaging* (in press)

Figure 2. Two-three year costs for varying diagnostic strategies: the EMPIRE and END registries



Key: EMPIRE = Economics of Myocardial Perfusion Imaging in Europe; END = Economics of Non-invasive Diagnosis; ETT = exercise tolerance test; cath = catheterisation; nuc = nuclear cardiology

Adapted from: Shaw. *ACC* 1999;**33**:661, Underwood. *Eur Heart J* 1999;**20**:157

Table 1. Principles of cost-effectiveness diagnosis and management of coronary artery disease using myocardial perfusion scintigraphy

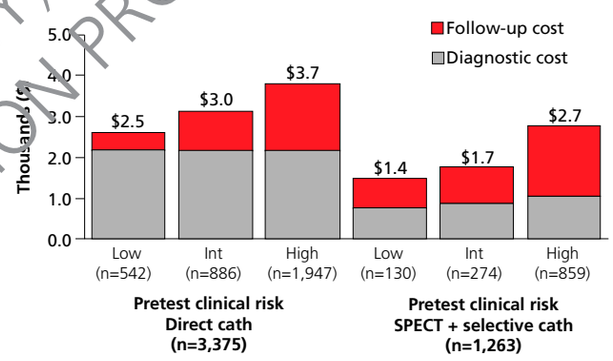
- High sensitivity excludes disease more accurately and avoids the need for a secondary test if a less accurate primary test is used
- High sensitivity leads to fewer false negative tests and avoids the cost of future events in undiagnosed patients with disease
- High specificity reduces the number of false positive tests and consequent downstream testing
- Additional prognostic information avoids need for further prognostic testing and focuses high-cost interventional care on patients with advanced disease and those with most to gain in terms of clinical outcome

coronary artery disease is high (>75%), in that although angiography was more costly it was also more effective.

2. At lower levels of CAD, some form of non-invasive approach was a better use of resources than a strategy of direct angiography, although NICE did not consider the procedural complications in lower-risk populations.
3. Strategies containing SPECT were likely either to dominate economically or to provide additional benefits that might be worth the extra cost when compared to a stress ECG-angiography strategy. The former produced more quality-adjusted life years (QALYs) at an acceptable cost. Evidence on the use of SPECT in acute MI or acute coronary syndromes (ACS) is limited but it does suggest that the use of SPECT provides cost savings and may be as effective as clinical data or angiography, in particular for lower-risk patient populations.

Table 2 summarises the ICER of SPECT versus other modal-

Figure 3. Diagnosis and two-year cost of care in women with stable angina



Adapted from: Shaw LJ, Heller GV, Travin MI, Lauer M, Marwick TH, Hachamovitch R, Berman DS, Miller DD. Cost analysis of diagnostic testing for coronary artery disease in women with stable chest pain. *J Nucl Cardiol* 1999; **6**(6):559

Table 2. Cost-effective test of choice

Low risk	Echocardiography
Low – intermediate risk	Echocardiography or SPECT
Intermediate – high risk	SPECT
High risk	Angiography

Table 3. Clinical and developing indications for myocardial perfusion scintigraphy (MPS)

Clinical indications
● Gatekeeper to angiography
● Pre-operative risk assessment
● Women
● Elderly
● Diabetes
● Revascularisation
● Acute coronary syndromes
● Imaging in erectile dysfunction
Developing indications for the use of MPS
● Ethnicity
● Evaluating effects of medical treatment
● Assessment of asymptomatic patients e.g. diabetes, metabolic syndrome, obese, coronary calcification

ities in patients with various degrees of coronary heart disease risk.

A review of the literature comparing stress echocardiography and stress ECG supports the view that patients at lower-intermediate risk should have echocardiography. This is because at a lower incremental cost, echocardiography is more cost-effective. But for the lion's share of patients, those at intermediate-high risk, SPECT will be used.

Table 3 gives the clinical indications for the use of MPS, and some developing indications for its use.

Round table discussion

● The cost-effectiveness of MPS

The panel felt that as societal health care costs become inexorably more expensive, the ability to show that a test is both better and more cost-effective is a good argument to take to health economists. The data show that MPS can make more efficient use of what we have.

● Reduction in waiting times

The ability to reduce waiting times is another important factor to show health economists. Use of an MPS investigation can serve as a filter before referral, and thus keep down the waiting time for angiography. Through the use of protocols and guidelines, risk stratification can be carried out in primary care and then only those patients who are at high risk need to be referred, appropriately, to the cardiologists.

● Value for money

The UK is perhaps better at measuring what is spent on healthcare than at measuring what is obtained for the money. Primary care is very rich in data, and accurate measurement of health care delivered is anticipated to improve as the relevant IT improves.

● Setting up an MPS service versus stress echocardiography

In cost-effectiveness arguments an assumption is made, in setting up competing technology such as stress echocardiography, that the machinery has to be bought and the staff trained from scratch. But most cardiology departments have an echocardiography department already, and it is relatively straightforward to upskill the technicians and acquire the relevant software.

In the setting up of any new service, such as stress echocardiography or nuclear cardiology, this needs to be done well so referring cardiologists have the confidence that the results of tests performed there will be of value. In both these technologies, the quality of reports depends on the operators. One of the advantages of nuclear cardiology is that because it is non-subjective, quality control can be much better, and images can, if necessary, be sent off for analysis.

Stress echocardiography is more difficult since the results reported are often operator-dependent. Until the software arrives that can produce objective and reproducible results, questions will remain about the reliability of stress echocardiography. Stress echocardiography can also sometimes produce a 'wild card' in that a dyskinetic segment produces discordant results because it affects the left ventricular ejection fraction.

Some of the figures used in cost-effectiveness data rely on modelling rather than real-life observation. These models are dependent on the assumptions used, especially for specificity, and they do not always factor in throughput and training. It is preferable to take patient-level data to health economists.

Present and future cardiac imaging in the UK: a cardiologist's perspective

JOHN CAPLIN

Introduction

Current levels of myocardial perfusion scintigraphy (MPS) and future levels calculated from National Institute for Clinical Excellence (NICE) recommendations represent a very tough target and a challenge (see table 1). Projected figures show that the UK will require another 140,000 scans per year and another 73 gamma cameras. Mobile scanning units have been proposed as a short-term solution.

What cardiologists need to know from imaging

Interventional cardiologists deal with ischaemic heart disease, congenital heart disease, valvular heart disease, heart failure and some arrhythmias. Imaging provides them with the following information:

- The site and anatomy of the lesion
- The micro-anatomy
- Functional downstream effects
- Inflammatory/thrombotic stability
- Cardiac function
- Prognosis

Detailed anatomy of lesions such as ventricular septal defects and abnormalities of the cardiac valves can be provided by coronary angiography, echocardiography, computerised tomography (CT) and magnetic resonance (MR) scanning (this last gives superb images of some of the anatomy). Details of the micro-anatomy can be obtained using angiography (which shows complex lesions and ulcers, for example) and using intravascular ultrasound (which shows the arterial wall and atheroma, for example). Such anatomy is important in deciding how to intervene.

MPS and downstream effects of vascular lesions

A benefit of myocardial perfusion scintigraphy (MPS) compared to other modalities is seen in this area. A lesion in the vessel wall may cause a region of flow heterogeneity that sets off a cascade of downstream effects. These include regional perfusion defects with abnormal regional metabolism, regional myocardial dysfunction, global dysfunction, ECG changes and angina.

There are several techniques to examine these downstream effects: ST segment depression may be seen on the exercise ECG, and abnormalities may be seen on dobutamine stress echocardiography (though these are sometimes difficult to interpret). Modalities such as conventional myocardial perfusion scintigraphy and positron emission tomography can detect perfusion abnormalities earlier plus can distinguish areas of viable and hibernating myocardium (see figures 1 and 2).

Key messages

- Myocardial perfusion scintigraphy (MPS) can detect perfusion abnormalities early and can distinguish areas of viable and hibernating myocardium
- Measurement of left ventricular ejection fraction by radionuclide techniques such as MPS is a good measure of long-term outcome
- There is a big gap between current MPS provision and future levels calculated from NICE recommendations

Cardiac inflammation

As atheroma progresses, inflammation develops and plaque is formed. This becomes thin and unstable, and breaks off to form thrombus. This process progressively blocks the artery. There is now evidence to support combination PET/MR imaging in looking at the inflammatory potential of lesions, which will help to guide management. In the field of cardiac function, multigated MR imaging is both accurate and reproducible, and echocardiography can also be used.

Prognosis data

It is generally thought that patients with triple-vessel disease have the poorest prognosis. Data to support this view come from the CASS study, which compared medical with surgical treatment in patients with triple-vessel disease. A prognostic benefit was observed among patients treated with coronary bypass surgery. But if all studies are pooled, it is found that

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Figure 1. Positron emission tomographic scans. **a** shows normal perfusion in the septum and lateral wall with reduced perfusion towards the apex. **b** shows F-deoxyglucose (FDG) and ammonia (NH_3) scans. FDG scans suggest preferential glucose uptake, a sign of ischaemic but viable myocardium, in the antero-apical segments, with reduced perfusion as shown by the NH_3 scan

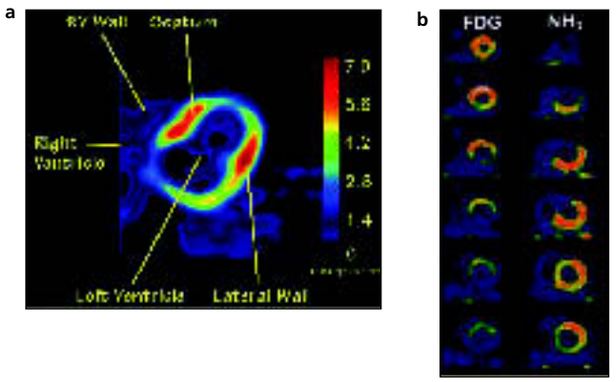


Figure 2. Assessment of cardiac function by radionuclide ventriculography. **a** shows an equilibrium or multi-gated acquisition (MUGA) study. **b** shows first-pass studies where a bolus of radionuclide is injected and imaged as it passes sequentially through the cardiac chambers

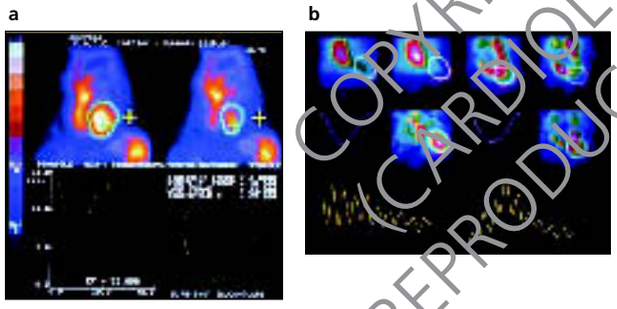
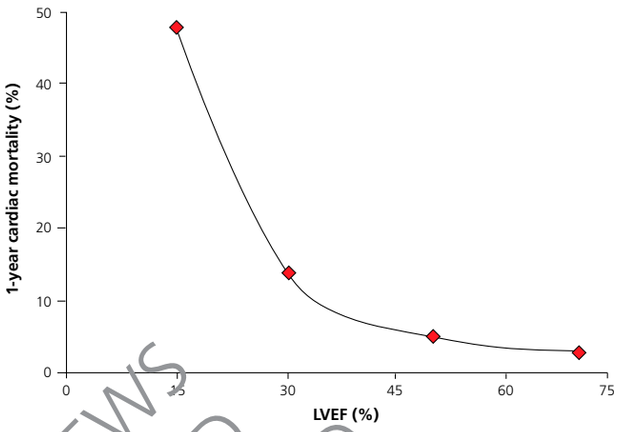


Figure 3. The relationship between left ventricular ejection fraction (LVEF), as assessed by radionuclide ventriculography, and one-year cardiac mortality following acute myocardial infarction



Adapted from: *N Engl J Med* 1983; **310**: 331-6

Table 1. Current and projected numbers of MPS scans, staff and waiting times

Now	Future
1,200 scans pmp	4,000 scans pmp
1,080 hours pmp	3,600 hours pmp
270 PAs pmp	900 PAs pmp
0.86 WTE pmp	2.9 WTE pmp
43 WTE England	145 WTE England
>20 week wait for scan	<18 week wait for whole patient journey

Key: pmp = per million population; WTE = whole-time equivalents; MPS = myocardial perfusion scintigraphy

bypass surgery buys the patient some time but that after 10-12 years the difference in prognosis is minimal.

The left ventricular ejection fraction (LVEF), as measured by radionuclide techniques such as MPS, is a good single measure of long-term outcome (see figure 3). In the last few years, much effort has been concentrated on patients with a very poor prognosis. For example, in the field of heart failure, many treatments (such as angiotensin-converting enzyme inhibitors) that have been introduced in recent years have made a difference to prognosis.

A cardiologist would wish an imaging modality to provide:

– quick results (particularly valid for in-patients)
– light, portable machinery
– accurate results (problematic with some imaging techniques)
– functional data
– information on thrombotic and inflammatory potential
– prognostic information
– data understandable for cardiac surgeons
– cheap results

Round table discussion

● Mobile MPS units

Mobile MPS units, initially introduced to help with increased MPS demand, have been found to have additional uses in planning a permanent service, in much the same way as mobile catheter labs performing coronary angiography have generated a business case for building fixed catheter labs. Mobile units

have relatively low set-up costs and come with trained staff, but the cost of a scan is greater. From the purchasers' point of view, however, mobile units have the advantage that the risk is lower if the service does not develop. If interest in a site is seeded with a mobile unit, there might be a role for assistance from the private sector or even NHS Trusts.

- Industry partnership

The field of diagnostics has to be well thought out if patient care is to improve. Industry could play a role in helping doctors to develop a high-quality nuclear cardiology service. PCTs have to spend a certain percentage of their budget in the private sector and the provision of this type of expert centre could be used by PCTs within this remit. They are currently keen to reduce waiting lists for angiography, which are steadily increasing. MPS is an ideal modality to provide a gatekeeping role, to determine who should be referred for angiography.

- Nuclear cardiologist/cardiologist partnership

Nuclear cardiology departments must work in partnership with cardiology departments instead of being isolated from them. It is vital for cardiologists to be involved in providing clinical feedback as films are interpreted and strategies planned. They need to be encouraged to use nuclear cardiology and to be educated on the validity of the results, using language that they can understand. Reports lose credibility if non-cardiological words are used. Nuclear cardiology cases should be presented more frequently at cardiac meetings, which would enable people with different perspectives and areas of expertise to give their comments and feedback.

- Training

Nuclear cardiology should be highlighted as an important part of training and its value emphasised by those in the field. As more centres set up nuclear cardiology departments, trainees will be expected to provide this service to larger numbers of patients.

Training in nuclear cardiology

Courses

The following courses in nuclear cardiology will take place in 2006:

- Nuclear Cardiology in Practice 2006. Royal Brompton and Harefield Hospitals, London. 6th-16th February 2006. Contact: c.walker@imperial.ac.uk
- European Society of Cardiology Nuclear Cardiology in Practice Training Course. Sophia Antipolis, France, June 2006. Contact: ebourg@escardio.org

Examination

The Certification Board of Nuclear Cardiology Annual Examination will take place on 23rd October 2005 in Vienna, Austria. Contact: www.cbnc.com

Myocardial perfusion scintigraphy – the way forward. How to influence the PCT to fund MPS

SARAH POWELL

Introduction

The implementation of the National Institute for Clinical Excellence (NICE) recommendations for the use of myocardial perfusion scintigraphy (MPS) is in line with key areas of the NHS Primary Care Trust (PCT) agenda. The key to gaining funding from the PCT is to make MPS relevant for the Trust and to speak the Trust's language in presenting the case for it.

Coronary artery disease (CAD) is an increasing problem: the Department of Health in its National Service Framework for Coronary Heart Disease and in the new General Medical Services (GMS) contract recognises that the care of coronary artery disease needs to be structured and improved. Indicators in the new contract require that practices hold a register of CAD patients, and that they are appropriately diagnosed and treated. These indicators can bring increased funding. Showing that the use of a diagnostic tool such as MPS could reduce the number of inappropriate hospitalisations is the sort of strategy that might encourage the PCT to implement the NICE recommendations.

In order to influence the PCT to implement NICE recommendations, healthcare workers need to work together in a variety of ways (see table 1).

Providing information for the PCT

To implement the NICE recommendations, the PCT needs to understand MPS and its place in the management of coronary artery disease (CAD). The types of questions the PCT will want answered are shown in table 2.

The Trust should be aware of national and local guidelines to support change in current practice. It is important to realise that no money is set aside specifically for NICE implementation, although PCTs are expected to consider NICE guidance when formulating Local Delivery Plans. Some organisations will 'top slice' money from their individual budgets, and a committee will decide priorities for NICE implementation; other committees will make recommendations on commissioning processes. The most important factor is to get MPS onto the agenda—if it is not on the agenda, it won't be discussed. The NHS budgetary planning cycle is based on three-year allocations, directly to the PCTs. Budget setting usually starts in September, and it is a good idea to get plans in early. It is helpful to find out when agenda items are discussed and reviewed, and to nominate a clinician to raise awareness of the benefits of MPS.

To gain funding, the business case needs to be aligned with the PCT agenda (see table 3). Table 4 shows an example of the process for NICE implementation once it becomes an agenda item.

There are practical issues to be addressed when the guidance is finally being locally implemented. First is the cost of introduction of MPS. Second is the phasing of its uptake, with the setting of priorities (perhaps the patient subgroup in which MPS works particularly well) and a timescale for its introduction. A two to three year approach is a good goal. Last, audit will need to be arranged to support implementation of MPS, with local action plans on monitoring and review. Each PCT will be slightly different so it is important to find out what happens locally. Many decision-makers will need to be won over: in addition to PCT representatives, a NICE implementation committee might include lay and professional members, specialists in finance, health law and ethics, and patient representatives.

Key messages

- The implementation of NICE guidance for myocardial perfusion scintigraphy (MPS) is in line with key areas of the Primary Care Trust (PCT) agenda
- PCTs need to be influenced to implement NICE recommendations
- Gain clinician involvement to increase awareness of the benefits of MPS
- Get MPS on to the PCT agenda and align the business case with the PCT agenda

Round table discussion

- Increasing influence of cardiac networks

The impetus for obtaining funding will come from the cardiac networks in the future. Historically these have been advisory but their influence is expected to grow and become more strategic.

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Table 1. Influencing Primary Care Trusts within local health communities to implement NICE recommendations

Health care workers need to work together to:

- Ensure clinicians have clinical freedom to use myocardial perfusion scintigraphy (MPS) where they believe patients will benefit
- Agree implementation of the NICE clinical guideline for MPS as a local priority, included in the Local Delivery Plan
- Identify any gaps between current practice and the NICE guideline
- Work across the primary-secondary interface to ensure agreement on the most appropriate diagnosis and referral pathway
- Involve patients in decisions about their care

Table 2. Questions the PCTs will want answered

Clinical
- Where does MPS fit into clinical management?
  - What, if anything, will it replace?
  - What will it prevent and how do we know?
  - What happens if we do not use it?
- How do we treat patients with known or suspected CAD at the moment?
- Are there any guidelines to support a change in practice?
  - National level
  - Local level
- Does MPS work?
  - Efficacy
  - Evidence-based review

Cost
- What will the pricing range be?
- Are there supporting health economic data on direct and indirect costs?
  - Number of patients needed to treat
  - Quality of life
  - Impact on other NHS services
  - Savings over current management

Implementation
- What will be the number and nature of the patients studied?
  - Local impact costs
- How will uptake be phased?
  - Who will be investigated and over what time scale?
  - Priorities
- What audit will be arranged to support implementation?
  - Local action plans on implementation, monitoring and review

Patients' views
- What are the views of individual patients, and patients' groups?

These organisations will increasingly act as a 'voice', rather than individual opinion leaders, and so it is vitally important that the cardiac networks are convinced of the benefits of MPS over other competing technologies. MPS should be included in Trust plans for both medical and imaging directorates to help it become more widely implemented.

Table 3. How to align the business case with the PCT agenda to gain funding

- Maximum health improvement within resources available
- Managing demand and improving access
- Achieving financial balance
- Maintaining and improving clinical governance reviews
- Rate of new technologies and therapies
- Engaging with the public to form an informed and articulate population
- Addressing postcode access
- Managing clinical and financial risk
- Linking changes in clinical practice with the modernisation agenda

Table 4. Process for NICE implementation

- Agenda item
- Evidence-based report
- Consideration within ethical framework
- Policy statement
- Local Action Plan
- Funding
- Communication
- Monitoring

Cardiac networks are currently looking for sources of information to put together high-quality datasets. Nuclear cardiologists need to become involved in defining the dataset, pointing out the inequalities that exist, to help move forward the nuclear programme. It is essential that nuclear cardiology is included in this dataset. The British Nuclear Cardiology Society is intending to move towards publication of annual web-based data. It was suggested that such data could be analysed locally in the future.

● Competing technologies

The NICE appraisal on MPS did not cover stress echocardiography, the main competing technology, since it was a less mature technology when the committee was gathering evidence. Any proposals for MPS funding must go beyond NICE in supplying data and give cardiologists the information they need to compare the two technologies. It is likely that the 2006 revision will contain evidence for echocardiography, especially with respect to its role in determining patient prognosis. The advent of an even newer technology, computerised echocardiography, is expected to be a real competitor to MPS.

Do we need more radiologists as cardiac imagers?

JONATHAN HILL

Introduction

There are 270 centres with gamma cameras in the UK, most led by radiologists with no subspeciality training in radionuclide radiology. Approximately 15 of these centres have departments that are led by a nuclear medicine physician or a dually accredited radiologist. It is thought that fewer than 15 radiologists have dual accreditation in radiology and nuclear medicine in the UK. Although more doctors are now applying for subspecialty training in radionuclide radiology, they are being attracted to the area by the use of positron emission tomography (PET) in oncology rather than the use of scanning in cardiology.

Training issues

One of the main challenges in attracting more radiologists to become interested in nuclear cardiology lies in structuring the content of radiology training. At present the core skills required by radiologists in their first three years of training (i.e. before they specialise) include reporting of magnetic resonance (MR), computerised tomography (CT) and ultrasound images. The training does not include reporting of cardiac nuclear studies, only understanding of the principles (cardiac anatomy, cardiac disease, familiarity with echocardiography, radionuclide investigations, MR, CT and angiography). The technique base in the first three years refers to cardiology briefly, although it now includes the option for PET imaging.

After the first three years, comprehensive training is possible for radiologists and physicians in their subspecialty of choice. Radionuclide radiology is taken to year 5 and dual accreditation to year 6 – both include requirements for nuclear cardiology. Subspeciality radiologists in nuclear medicine therefore have sufficient training and are equipped to develop nuclear cardiology in their workplace. But currently this is unlikely to happen. Many prefer to move into oncology at this stage, perhaps because nuclear cardiology is not regarded as a core subject in the initial training.

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Key messages

- Very few radiologists have dual accreditation in nuclear medicine and radiology
- Cardiac nuclear studies should be included in the first three years of training to encourage more radiologists to move into this area
- Subspecialty radiologists in nuclear medicine have sufficient training and are equipped to develop nuclear cardiology in their workplace
- Suitable courses or competency programmes need to be put in place for other personnel in this area

Addressing the deficiency in exposure to nuclear cardiology during the first three years of training ought to encourage more radiologists into the field, although there are pressures on the curriculum from the newer imaging modalities. Those already working in this area – radiographers, technologists, physicists and nurses – could increase their competency by leading studies and research projects, or learning reporting skills, for example. Interest and skills in this field could also be expanded through the provision of courses, degrees and diplomas.

The advent of gamma camera hybrid imaging, such as PET/CT imaging in the diagnosis of malignancy, is also attracting more radiologists into the subspecialty. Although the competing technologies of MR/CT may take over as the prime driver of imaging in time, radiologists will need to use the most efficient appropriate technology for cardiology patients.

Future directions

There are exciting future possibilities in the field of nuclear cardiology (see table 1). Computerised tomography may replace diagnostic cardiac angiography, enabling clinicians to examine both the inside and the outside of the arterial lumen. Magnetic resonance imaging may be used to visualise reversible myocardial ischaemia, though it is likely to be several years before the associated software problems are solved.

In the next five to 10 years, PET/CT with 64 slices is predicted for investigation of cardiac anatomy and function. PET/MR will be particularly useful for patients with equivocal findings

Table 1. A summary of possible future imaging techniques in the field of nuclear cardiology

- CT scanning of cardiac anatomy
- MR evaluation of reversible myocardial ischaemia
- PET/CT evolving to PET/MR assessment of cardiac anatomy and function assessment of cardiac anatomy and function
- DNA imaging techniques

Key: CT = computerised tomography; MR = magnetic resonance; PET = photon emission tomography

on single photon emission computerised tomography (SPECT). DNA mapping may ultimately lead to probing and imaging techniques for investigation of cardiac genetics.

Round table discussion

- **Communication between different specialists**

One reason why cardiac radiologists may not pursue their subspecialty is because so much cardiac investigation work is being done by the interventionists. But as the techniques of cardiac CT and cardiac MR become more popular, this will have to change. If targets such as those in the NICE appraisal are to be met, the sheer numbers involved will mean radiologists and nuclear physicians will need to work together.

The different ways of reporting the findings of investigations between different specialties needs to be overcome in order to improve communication between cardiologists and radiologists. This could be done by including nuclear medicine at case conferences which involve practitioners from a number of different disciplines.

- **Increasing trainee numbers**

Trainees need to be encouraged to enter the field of nuclear medicine since the current numbers of nuclear physicians coming through the system will not be able to cope with the workload of patients with cardiovascular disease. Good-quality studies from the US, investigating the links between findings on cardiology imaging, patient prognosis, risk stratification and appropriate patient management, could be a stimulus.

Differing levels of skills are needed in the area. While experienced practitioners are needed to interpret the findings in difficult cases, it is likely that a technologist will have the necessary skills to supervise the treadmill and inject the isotope. It would also be helpful to have practitioners who have experience of all the different investigational techniques – echocardiography, CT scanning, angiography and so forth – so that they could decide which test was the most appropriate for the patient.

Cardiology training might be developed along these lines, with cardiac imaging becoming a subspecialty with six months working in the chosen modality. In addition, a proper career structure needs to be worked out.

Myocardial scintigraphy – the secondary care view

MARK DANCY

Introduction

Implementation of the National Institute for Clinical Excellence (NICE) guidance on myocardial perfusion scintigraphy (MPS) will be facilitated by the development of protocols for clinical use. This requires consideration of the patterns of coronary artery disease, how patients are referred, and which patients might benefit most from MPS.

Sources of patients with coronary artery disease (CAD), who may need investigation with MPS, are rapid access chest pain clinics (RACPCs), the coronary care unit (for patients with acute coronary syndromes), heart failure clinics and general cardiology clinics. The National Service Framework for Coronary Heart Disease has encouraged clinicians to draw up evidence-based protocols for the investigations of patients with possible ischaemia, and the NICE guideline for MPS is an important source.

Questions to be addressed in patients with possible myocardial ischaemia are shown in table 1.

Comparison of tests

Various tests are available to investigate CAD. Exercise testing is convenient and safe (mortality during testing is only one in 10,000) but some patients cannot carry out the protocol. In addition, the tests are more difficult to interpret in patients with resting ECG abnormalities such as bundle branch block, in patients with hypertension, in women and in Asians.

Nuclear cardiology is particularly useful for patients who are unable to exercise, those with resting ECG abnormalities, women and diabetic patients. The latter is a particularly difficult group to assess, risk-stratify and manage appropriately.

Myocardial perfusion scintigraphy has a higher sensitivity compared to some other tests for ischaemic heart disease. The sensitivity and specificity of exercise ECG is about 78% and 70%, respectively, compared to about 90% sensitivity and 70% specificity for MPS, and about 81% sensitivity and 80% specificity for stress echocardiography.

Figures for these parameters show how useful nuclear tests are in women: the sensitivity of exercise ECG is only 61% and the specificity 70%. By contrast, nuclear testing has a sensitivity of 85% and a specificity of 92%. None of these tests will pick up coronary stenoses that are not flow-limiting.'

The prevalence of coronary heart disease (CHD) in women lags that in men by about 10 years: among those aged 55 to 64 years, 4.4% of women and about 9.0% of men have CHD; among those aged 65 to 74, the prevalence is 10.7% in women and 19.4% in men. The high sensitivity and specificity of MPS using SPECT, even in patients thought to be at low cardiovascular risk, mean that it is very well placed for risk stratification and prediction of cardiovascular events in women.

The indications for stress echocardiography are similar to those for MPS, though some women are poor subjects for echocardiography. It is cheaper than nuclear testing and involves no exposure to radiation, but for maximum usefulness it needs both a skilled operator and a skilled interpreter of the findings. The role of stress echo is not yet covered by guidance from NICE but this is expected in the next revision. Any discussion on implementation of an MPS service needs to include stress echocardiography in the evaluation.

In the UK, coronary angiography remains the gold standard in investigation of the coronary vessels. It allows interventionists to make detailed plans for revascularisation in a way that other tests cannot do. However, it does carry the highest risk, including a mortality risk of one in 1,400.

Key messages

- Protocols must be developed for the implementation of the NICE guidance on myocardial perfusion scintigraphy (MPS)
- MPS is particularly useful for patients who are unable to exercise, those with resting ECG abnormalities, women and diabetic patients
- MPS has comparable sensitivity and specificity to some other tests for ischaemic heart disease
- Stress echocardiography was not evaluated in the NICE guidance; discussions on implementing MPS services need to be evaluated against this modality

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Table 1. Questions to be addressed in patients with possible myocardial ischaemia

In those patients who are not known to have coronary ischaemia:
- Is the chest pain caused by ischaemia?
- Are the patient's symptoms due to ischaemia?
- How severe is the ischaemia?

In those patients who are known to have ischaemic heart disease, such as those who have had a myocardial infarction or those with positive findings on coronary angiography:
- Where is the ischaemia?
- Is targeted revascularisation a possibility? Does the patient have blocked arteries? How difficult would coronary intervention be in this patient?
- How extensive is the ischaemia?
- What is the potential for improvement in left ventricular function if revascularisation is performed?

Table 2. Uses of myocardial perfusion scintigraphy

- Patients with intermediate or low risk of coronary artery disease (CAD) and inconclusive exercise tests
- Patients with intermediate or low risk of CAD who cannot exercise
- Patients with higher risk of CAD and odd symptoms
- Patients with known coronary anatomy, for planning revascularisation
- Patients with heart failure who might benefit from revascularisation
- Asymptomatic diabetic patients

Who should MPS be used for

Looking at available tests in secondary care, there are certain groups of patients who will benefit most from myocardial perfusion scintigraphy. These are summarised in table 2.

The role of primary care in the appropriate use of myocardial perfusion scintigraphy

MARK DAVIS

Introduction

Coronary heart disease (CHD) is a major priority for the government. There is continuing political support for initiatives to reduce its prevalence and to tackle the burden of disease. The Department of Health has published National Service Frameworks for CHD, diabetes and older people, and there are many other sources of information and guidance for general practitioners in the UK. Guidance from the National Institute for Clinical Excellence (NICE) is becoming increasingly helpful. The British Cardiac Society, the Joint British Societies' and the British Hypertension Society's guidelines, as well as the Scottish Intercollegiate Guidelines Network (SIGN), all tackle CHD and cardiovascular disease prevention. However, the biggest driver for change in general practice is the new General Medical Services (nGMS) contract, with its Quality and Outcomes Framework.

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Key messages

- The balance of power is being shifted from secondary to primary care for chronic disease management
- Practice-led commissioning means that primary care will be accountable for resources
- Clinical engagement of all physicians is essential for successful service improvements
- Cardiac networks will be influential in the redesign of cardiac pathways

John Hutton, speaking on behalf of the Department of Health in October 2004, emphasised that primary care is the foundation of the NHS and that it is central to the future of the NHS (see table 1). He predicted that general practitioners with a special interest (GPSIs) will take over the role of secondary care in chronic disease management, that good-quality care will be rewarded. Also he expects that primary care will fashion new services and that new

Table 1. The future of primary care (John Hutton on behalf of the Department of Health, October 2004)

- Primary care is the foundation of the NHS
- Primary care is central to the future of the NHS
- Primary care has an extraordinary future
- GPSI will take over the role of secondary care in chronic disease management
- Quality will be rewarded
- Primary care will fashion new services
- New providers will be encouraged to enter primary care

providers will be encouraged to enter primary care.

The clinical indications for myocardial perfusion scintigraphy (MPS) fit within the clinical remit of cardiology but primary care now has the main commissioning role. How will GPs get involved in this process?

Practice-based commissioning

Primary care is being encouraged to become involved in this project. This locality commissioning model fits with the Primary Care Trust (PCT) remit of service redesign and commissioning. All practices now have the right to hold budgets and all practices are expected to be engaged by the year 2008. Practices will look at all aspects of the patient pathway and commission "appropriate care, in an appropriate setting, by an appropriate person". One result of practice-led commissioning is that primary care will be made accountable for the use of resources. Primary care will need to think carefully about costs, particularly since the arrival of "payment by results". It is hoped that practice-led commissioning will engage the 'front line' and will encourage a radical service redesign.

Clinical engagement

The Improvement Partnership for Hospitals (IPH) was established by the NHS Modernisation Agency to support efforts to improve NHS services, "to deliver better care without delay across the patient journey". The IPH states that clinical engagement is the critical factor in successful service improvement initiatives, and that engagement of all clinicians is important. National Clinical Leads (both hospital consultants and general practitioners) are at the heart of the strategy. The ultimate goal is to develop the capacity of local healthcare systems to improve their own services. In order to engage clinicians, local innovations must be sound and must focus on better care, not just care without delay.

Pathways redesign

The development of cardiac networks is seen as crucially important for the delivery of good patient care. The pathways will be developed even further in the future. Cardiology redesign is a priority for the Care Pathways Project. The redesign will cover specific conditions such as heart failure, angina and chest pain. In addition, generic issues such as diagnostics, unscheduled care, discharge and rehabilitation will be considered across the project.

Round table discussion

- **Testing in diabetics, and symptomatic versus asymptomatic patients**

Looking at diabetics, two thirds of people with myocardial infarctions who are admitted to hospitals have abnormalities in their glucose metabolism, and the majority of these have overt diabetes. Although those with a body mass index over 30 present an imaging challenge, neither do they find it easy to exercise on the treadmill.

In continental Europe, patients are not investigated until they are symptomatic, so should we be screening patients? Diabetes is regarded as a CHD risk equivalent, and prevention of cardiovascular disease is important, but we are not likely to investigate patients for coronary artery disease unless they are symptomatic. Patients with extensive ischaemia are more likely to die suddenly: if we know that the patient is high-risk and that the risk can be reduced, then that is significant. MPS using single photon emission computed tomography (SPECT) is the prime imaging technique for diabetic patients, according to NICE. Nevertheless, there are difficulties in extrapolating data from symptomatic to asymptomatic patients, for they are different populations.

In the US it is assumed that diabetic patients have a higher event rate. In diabetic women the risk is increased between three- and 10-fold but if they have a normal scan then in practice they have roughly the same event rate as the normal population.

There is evidence that some interventions can reverse the increased risk that diabetics run. In EUROPA (European trial on Reduction Of cardiac events with Perindopril in stable coronary Artery disease), the diabetic patients had twice the event rate and benefited greatly with the ACE inhibitor perindopril. Statins can also attenuate the progression of CAD. Also, revascularisation is a possibility in diabetic patients who are found to have a large ischaemic area on SPECT.

Patients for whom heart transplantation is planned have nuclear imaging of their hearts, and this often turns up severe disease. But data are lacking from patients with milder disease. It would be feasible to perform a resting study in asymptomatic patients to look for undetected disease, but such patients could not be turned away from transplantation.

- **Movement to primary care**

There is a need for protocols to move these services into primary care, to help people with less experience to administer these tests appropriately. Cardiac networks in rural areas cross a number of PCTs. The West Yorkshire Cardiac Network, for example, has a catchment of four million people. The networks can produce a health economy appraisal and say that they think that a particular service should be offered to all PCTs (a decision which it is relatively easy for a PCT to accept).