Myocardial perfusion imaging in Denmark: activity from 1997 to 2001 and current practice

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Abstract. A questionnaire was sent to all departments of nuclear medicine in Denmark (*n*=20) asking for details of myocardial perfusion imaging (MPI), including the number of patients examined each year from 1997 to 2001 and the current clinical and technical practice. All (100%) departments replied, and the survey thus covers all MPI performed in Denmark during the period in question. The number of MPI studies (examined patients) was 2,531 in 1997 (0.47 MPI/1,000/year) and 4,961 (0.93 MPI/1,000/year) in 2001, which is a doubling in activity in 5 years. Nineteen (95%) of the Danish departments performed MPI in 2001, and 14 (74%) of these reported that activity had increased over the past 5 years. MPI activity was unevenly distributed between hospitals and regions. In 2001, the university hospitals in the central Copenhagen region (capital) accounted for the highest MPI activity (2.00/1,000/year), while the non-university hospitals in general had the lowest activity rate (0.73/1,000/year). The most pronounced increment found in the period was observed in the university hospitals outside Copenhagen, where activity increased by 300% from 0.44/1,000/year in 1997 to 1.33/1,000/year in 2001. All departments providing MPI used tomographic acquisition technique and all departments used technetium tracers. The more sophisticated techniques of MPI – gated acquisition, attenuation correction and iterative reconstruction – were used in 74%, 32% and 42% of departments, respectively. The stress mode in perfusion studies was dipyridamole/adenosine in 76%, exercise in 18% and dobutamine in 6%. Despite these encouraging figures, MPI activity for 2001 remained well below what is recommended by other national and international societies. The anticipated further increase in nuclear cardiology is encouraging, but the nuclear medicine community needs to address the issues that prevent it from keeping up with demand. In general, the restricted camera time and the limited number of trained personnel explain the excessive waiting lists in Denmark.

Keywords: Myocardial perfusion imaging – Activity

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Introduction

National guidelines on clinical practice with myocardial perfusion imaging (MPI) were published in 1998 in an effort to standardise referral and technique in Denmark [1]. The current survey was conducted to ascertain whether the activity is comparable with that in other European countries and the United States. Other national surveys have described an increased activity in this field over recent years [2, 3]. As there has been no previous published national survey on the activity and practice of MPI in Denmark, we intended to describe the MPI activity over the last 5 years.

Materials and methods

On behalf of the nucleus of The Danish Working Group of Nuclear Cardiology, a questionnaire was sent to all departments of nuclear medicine in Denmark in early June 2002. The questionnaire requested information about MPI activity (number of patients examined per year) from 1997 to 2001. Departments were asked how many weeks a referred patient had to wait for examination. Furthermore, questions about current practice were included. Non-responders received a reminder and/or were reminded by a telephone call in July 2002.

By late July 2002, responses had been obtained from all 20 departments (100%), covering 100% of MPI performed in Denmark. Perfusion studies with PET technique or magnetic resonance imaging were not included in the survey, since the activity level is negligible in Denmark.

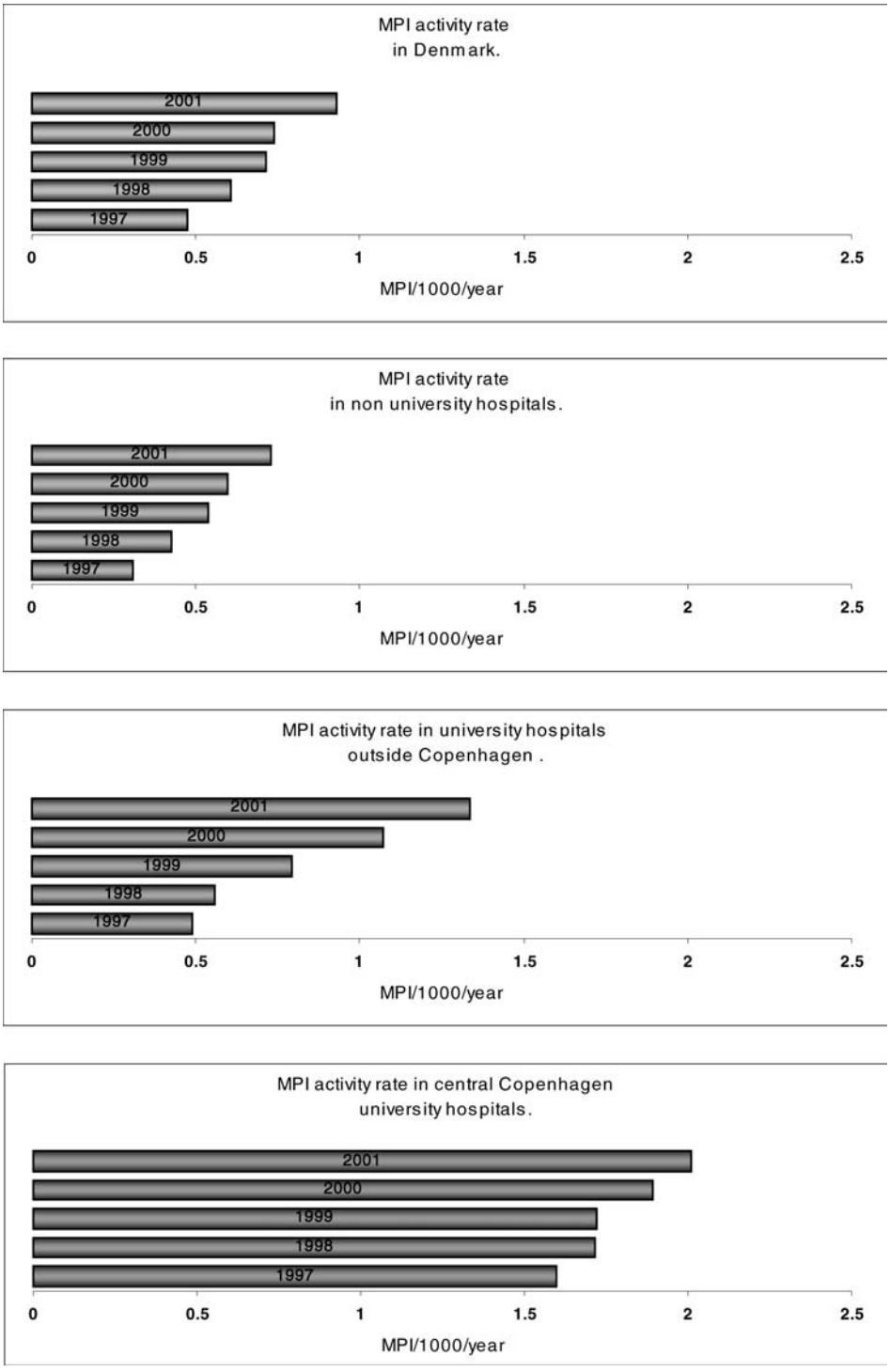

Fig. 1. National and regional myocardial perfusion scintigraphy (MPI) activity rates from 1997 to 2001. An increasing trend in all regions is observed. The highest activity is observed in University Hospitals in the Copenhagen region. The most pronounced increase in activity is observed in University Hospitals outside Copenhagen. A relatively low activity is observed in the non-university hospital

Results

Activity

The total number of MPI studies in Denmark, which has a population of approximately 5,350,000, was 2,531 in 1997, 3,276 in 1998, 3,808 in 1999, 3,953 in 2000 and 4,961 in 2001. These figures are equivalent to activity levels of 0.47 studies/1,000/year in 1997 increasing to 0.93 studies/1,000/year in 2001.

Of the 20 departments and centres, 19 (95%) provided a nuclear cardiology service including MPI. Of these 19 departments, 14 (74%) reported that the number of MPI had increased and 4 (21%) that the activity was unchanged. One department (5%) had stopped providing MPI owing to a lack of staff.

The activity was unevenly distributed between hospitals and regions in the country, as illustrated in Fig. 1. The highest activity was observed in university hospitals in the central Copenhagen region, whereas the lowest ac-

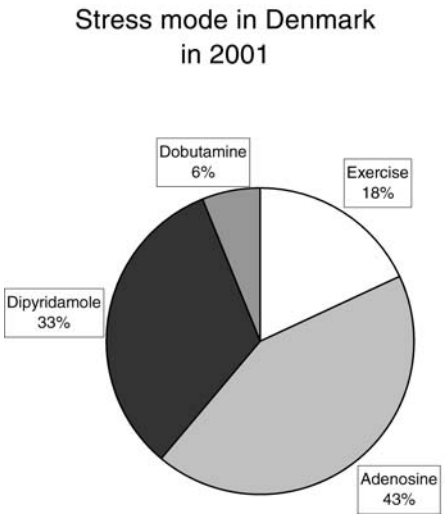

Fig. 2. Choice of stress protocols in Denmark in 2001. The majority of studies (76%) were performed as pharmacological vasodilator stress

tivity was observed in non-university hospitals. The highest increment in MPI activity in the 5-year period was observed in university hospitals outside Copenhagen (300%). In 2001, two departments of nuclear medicine in university hospitals outside Copenhagen accounted for 30% of MPI in Denmark. In 2001, three departments performed less than 100 MPI studies/year.

Waiting list and capacity

The mean waiting time was 5.1 weeks, varying from 1 week to 13 weeks. Departments were asked what their potential was to increase MPI. All departments would be willing to increase MPI procedures in accordance with clinical demand if financial compensation and the necessary equipment were to be provided. One department would be able to increase the number of MPI studies by 100/year without extra supply of personnel or gamma cameras.

Techniques

All 19 departments used technetium-99m labelled tracers (tetrofosmin or sestamibi) and all used tomographic acquisition. Images were reconstructed iteratively in eight departments and by filtered back-projection in 11. ECG-gated MPI technique was used by 14 departments, two did not describe the procedure and three did not use gating technique. Six centres used attenuation correction, two did not specify this and 11 did not use this technique.

In 2001 stress was performed with adenosine in 43% of the studies, with dipyridamole in 33%, with exercise in 18% and with dobutamine in 6% (Fig. 2).

Discussion

Activity

This survey is unique in that it encompassed all MPI performed in Denmark from 1997 to 2001. The total number of MPI studies in Denmark during these 5 years was equivalent to activity levels of 0.47 studies/ 1,000/ year in 1997, increasing to 0.93 studies/1,000/year in 2001: an almost twofold increase in activity over 5 years. Despite this encouraging increase, the ongoing activity seems low and inadequate to meet the needs of cardiac patients.

As long ago as 1994 the British Cardiac Society recommended 2.2 MPI studies/1,000/year as adequate to serve the needs of patients with cardiac disease in the United Kingdom [4]. Also in 1994, Pennell and colleagues reported the European average for nuclear cardiology activity to be 2.2 studies/1,000/year [2]. Few data have been published on activity in nuclear cardiology within the past few years. Recent data are available for only a handful of countries. Overall there has been an increase in nuclear cardiology, with a substantial increase in MPI and a fall in the number of radionuclide ventriculography studies. In 1997, 12,556,000 nuclear medicine and 4,182,000 nuclear cardiology procedures were reported in the United States, which equates to 47 nuclear medicine and 15 nuclear cardiology studies/1,000/year [5]. In Japan the activity for the same year was 14.7 and 2.0 nuclear medicine and nuclear cardiology studies/1,000/year, respectively [6]. Spain reported 16.7 and 1.1 nuclear medicine and nuclear cardiology studies/1,000/year in 1999 [7]. A recently published UK survey of nuclear cardiology in 1997 [8] reported that MPI activity has risen steadily from 0.19 studies/1,000/year in 1988 to 0.86 studies/1,000/year in 1997. In 1997 the MPI activity in the United Kingdom was almost twice the activity in Denmark (0.47/1,000/year). However, the huge Danish increase in activity observed in the last 5 years may have placed Denmark on a comparable level with the United Kingdom.

The national figures in Denmark obscure an inhomogeneous regional activity. At present, the highest activity is observed in the university hospitals of Copenhagen (the capital of Denmark), with 2.00 MPI/1,000/year. On the other hand, the highest increase in MPI activity from 1997 to 2001 was observed in university hospitals outside Copenhagen, with an increase of 300%. In 2001, two departments of nuclear medicine in university hospitals outside Copenhagen accounted for 30% of the MPI studies performed in Denmark. In 2001, three departments carried out fewer than 100 MPI studies per year.

The main reason for the increase in activity is undoubtedly the dissemination of the extensive literature that now exists on the clinical utility of MPI. A challenge for cardiologists as well as specialists in nuclear medicine may be the future use of MPI in the acute phase of cardiac disease. Diagnostic strategies using MPI in the acute phase of chest pain could substantially in-

crease the number of MPIs needed. A recent paper dealing with this issue has documented the clinical value of MPI in this context, as it significantly reduces hospitalisations for chest pain, thereby restricting hospital admission to more appropriate patients [9].

Technical standard

The current (2001) techniques in Danish nuclear medicine departments seem in general to be in agreement with international standards. All departments use technetium tracers. All MPI studies are performed as tomography and as many as 74% of departments use gated acquisition and 32% use attenuation correction. These figures indicate a high technical standard compared with figures from other surveys [8].

Specification of stress protocols indicates a preference for pharmacological vasodilation techniques since 76% of all stress procedures were performed with dipyridamole or adenosine. This number seems high compared with international practice [8]. National and international recommendations suggest that physical exercise should be used whenever possible [10]. The present survey does not allow for an in-depth analysis of whether appropriate stress protocols were chosen.

Why is MPI activity low in Denmark?

Several factors may be responsible for the low MPI activity in Denmark. Despite the encouraging increase in activity, it appears that MPI is not widely used as the gatekeeper to coronary angiography. The optimal level of MPI activity is unknown. However, compared with MPI activity in the United States, that in Denmark and Europe generally is low. Different systems of financing and reimbursement in medical care could be part of the explanation. However, the present activity of 0.93 MPI/1,000/year in Denmark is too low.

In Denmark all MPI procedures are carried out in nuclear medicine departments and not as an integrated procedure in the department (and mind) of cardiology. Nuclear medicine is a separate medical specialty in Denmark, as in most European countries. Based on our waiting list figures, there is no doubt that at present clinical demand exceeds production. An average waiting time of 5 weeks is unacceptable for patients with ischaemic heart disease. As a consequence of the long waiting lists, MPI may be skipped and the cardiologist may handle these patients according to a more rapid and flexible diagnostic strategy. In practice they refer patients to diagnostic coronary angiography, especially if there is sufficient capacity in the catheter laboratory. All Danish departments of nuclear medicine intend to increase their activity, if there is a clinical demand. Although one department reported that it would be able to increase activity by 100 MPI studies per year without extra supply of personnel or gamma cameras, all other departments had reached their maximal level of production.

In Denmark the National Board of Health and the Ministry of Health have in recent years focussed on the invasive procedures in cardiology. Recognising that activity in this field was insufficient compared with that in other European countries, substantial political and economic resources have been invested in this field over the last 5–10 years. As a consequence, coronary angiography activity increased from 667/million/year in 1990 to 3,053/million/year in 2000 [11]. Revascularization procedures have increased from 186/million/year in 1990 to 1,555/million/year in 2000 [11]. We approve of this progress and believe that the increase in MPI activity is a spin-off from the strategic investment in the invasive cardiology. However, we recommend that there should be a specific focus on the non-invasive diagnostic imaging techniques, including MPI, in order to bring the activity in this field up to international standards.

The goal must be to increase the rate of revascularization per coronary angiography procedure – in other words to define coronary angiography as a pre-operative or pre-revascularization procedure and not as a diagnostic tool. In order to increase the use of MPI, extra supply of staff and gamma cameras to departments of nuclear medicine is necessary.

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