Eur J Nucl Med Mol Imaging (2013) 40:976–978
DOI 10.1007/s00259-013-2352-8

UEMS/EBNM

Nuclear medicine training and practice in France

Eric Gremillet · Bernard Lemaire · Alain Prigent · Jean-Philippe Vuillez

Published online: 23 February 2013

Historical notes

The mission of nuclear medicine (NM) is the use of unsealed radioactive substances for diagnosis and therapy. For training in the "use of artificial radionuclides in medicine", a Certificate (*Attestation d'études relatives aux applications à la médecine des radioéléments artificiels*) and a Licence (CES: *Certificat d'Etudes Spéciales relatives aux applications en médecine*) were created in 1962 and 1973, respectively. Until 1988, holders of this Certificate and later the CES were recognized as NM specialists. During a transition period from 1988 to 2000, a primary (DES) or a secondary supplementary (DESC) specialty degree was awarded. NM was recognized as an exclusive medical specialty in 2000 (DES: *Diplôme d'Etudes Spéciales de médecine nucléaire*).

NM is a "full" specialty with an exclusive practice. However, after a specific and well-defined procedure (i.e. 2-year minimum theoretical and practical training and after passing an examination) some physicians (an average of two a year) from other specialties (endocrinology, cardiology, internal medicine…) may become NM specialists. As in France a physician can be certified for only one specialty, these "secondary" NM physicians are no longer allowed ("certified") to practise in their initial specialty by the National Health Authority.

Organizational workforce

There are currently about 220 departments of NM in France, while the total number of NM physicians is about 600 (580 in January 2011). Among these 220 departments, about two thirds (145) are in public practice and the remaining third (75) are in an exclusive private practice. Regarding NM physicians, 340 specialists (about 55 % of the total) have an exclusive public practice, 170 specialists (30 % of the total) have an exclusive private practice, while about 85 (15 % of the total) have both a public and a private practice (either mainly public practice with part-time private practice or vice versa).

Training resources and organization

Ninety departments are recognized as certified training centres. Some departments may have two trainees (in French: *interne*) at the same time. This certification is awarded by the Regional Health Authority (*Agence Régionale de Santé*, ARS) for 5 years. This certification is granted based on a report from the Nuclear Medicine Training Coordinator of the University. The applying NM department should meet the requirements of a questionnaire (numbers of certified NM specialists and of university trainers, numbers

E. Gremillet
Centre d'Imagerie Nucléaire, 42030 Saint-Etienne Cedex 2, France

B. Lemaire
National Professional Board of Nuclear Medicine,
59700 Marcq en Baroeul, France

A. Prigent (✉)
Faculté de Médecine Paris-Sud - Université Paris XI,
Service de Biophysique et Médecine Nucléaire,
Centre Hospitalier de Bicêtre,
94275 Le Kremlin Bicêtre Cedex, France
e-mail: alain.prigent@bct.aphp.fr

J.-P. Vuillez
Clinique Universitaire de Médecine Nucléaire,
38043 Grenoble Cedex 9 INSERM U-1039,
38700 La Tronche, France

and types of cameras and radiation protected chambers for therapy, annual numbers and types of examinations, publications…) and propose a training programme. This report is prepared after the visit to the NM department by the members of the training committee, including biophysics and NM professors, NM practitioners and a representative of NM trainees. Training centres have been only public departments until recently, but for a few months, one private centre was accredited for training.

At the end of the medical degree, 4 years of training (as resident, called *interne* in France) are required to become an NM physician. Within this 4-year period of residency, every semester the resident rotates either in NM accredited departments (four semesters) or in departments of "associated" clinical specialties, such as internal medicine, oncology, cardiology and endocrinology (four semesters). The numbers of the different types of exams and therapies performed during the four semesters in NM departments are reported in a trainer booklet regularly checked by the trainer. Because of the new developments in NM [e.g. cadmium zinc telluride (CZT) camera, new positron emission tomography (PET) tracers, yttrium-labelled microspheres …], we have made a request to the National Health Authority for a 5-year training period adding a 1-year fellowship (called *assistant spécialiste*) to the 4-year residency.

Every 5 years the National Health Authority specifies the number of residents allowed to begin the training programme (national adjustment) in each university having NM departments. For the period 2012–2017, this number varies from 37 to 41 a year. Consequently between 2012 and 2017, 193 trainees are authorized to choose NM as their medical specialty and eventually become NM specialists.

Our national training programme is very similar to the recently updated "Syllabus for Postgraduate Specialization in Nuclear Medicine" [1], both regarding fundamental and clinical training. Regarding hybrid or multimodality imaging training, in agreement with the syllabus and contrary to the "Multimodality Imaging Training Curriculum" prepared by the European Society of Radiology (ESR)/European Association of Nuclear Medicine (EANM), there is no requirement for a rotation in diagnostic radiology departments, as this domain is only taught in NM departments where all the hybrid imagers are appropriately located.

Our national syllabus includes fundamental training for an average of 650 h (national course at the National Institute of Nuclear Science and Technology, INSTN). The only slight difference concerns the quotas of exams proposed in the European Union of Medical Specialists (UEMS)/European Board of Nuclear Medicine (EBNM) syllabus, which are regarded as recommendations (most often met by the student as shown in his trainee booklet) rather than requirements.

The examination of the fundamental training includes a written exam composed of short answer questions about atomistic and matter interactions, radiopathology-dosimetry-radioprotection, instrumentation [gamma camera, single photon emission computed tomography (SPECT), PET, physics-based artefact corrections and quantification, MRI, CT, sonography], radiopharmaceuticals, tracer kinetics and modelling, and image processing, etc. The "clinical" part of the fundamental training is assessed by 100 multiple choice questions on all clinical (diagnostic and therapy) fields of NM.

In addition, at the end of the training, the student has to prepare an end of training report written in a submitted article format presenting an original work. This work is also presented in front of a professional and university jury. In a separate session or at the end of this presentation, the candidate has to answer any question from the jury members covering the field of NM (fundamental and clinical training).

The Diploma of the initial education programme is awarded by the University Medical Faculties and the Qualification by the National Council of Medicine Board (*Conseil National de l'Ordre des Médecins*)

Continuing education and professional development

Continuing medical education (CME)/continuing professional development ((CPD), a regulatory requirement, is managed by a scientific committee, which is dependent on the National Professional Board of Nuclear Medicine. This Board is composed of members of the French Society of Nuclear Medicine (SFMN), the National College of Biophysics and Nuclear Medicine (CNEBMN) and the National Syndicate. CME/CPD organized by a certified CPD institution abroad could eventually be acknowledged.

International recognition

Nine French NM specialists passed the Fellowship examination and are FEBNM. This figure is rather low because even if it is looked upon an added value, the Fellowship of the UEMS/EBNM is considered as a stage in the CME/CPD rather than as a mandatory part of the final exam of initial national training. Although the UEMS/EBNM aims to define requirements for the promotion of free movement of specialists within the EU with harmonization of the highest level of training of the medical specialists, this Fellowship has not yet been acknowledged for such an automatic agreement.

Regarding the distinguished memberships of French NM specialists who have contributed to the progress of the

specialty via their international positions (such as EANM, UEMS/EBNM…), we may mention:

– Prof. Pierre Jallet, first President of the *Société Française de Biophysique et Médecine Nucléaire* (1983), Jacques Chambron (Strasbourg 1989), Serge Askiénazy (Paris 2000) and Dominique Le Guludec (Lyon 2013) as Presidents of EANM congresses, Serge Askiénazy (1991–1993) and Patrick Bourguet (2011–2012) as Presidents of EANM, Serge Askiénazy as Honorary Member of EANM, Bernard Bok (1994–1997) as President of the UEMS/EBNM, Eric Gremillet as Chairman of the Committee on Accreditation of Nuclear Medicine Departments of the UEMS (2003–2005) and Alain Prigent as Chairman of the Education & Syllabus Committee of the UEMS (since 2007).

Final comments

Our wishes concerning UEMS/EBNM are that it can carry on its missions, which are to maintain and defend the quality of general standards, to develop the speciality by defining necessary qualifications, to improve and harmonize the training and CME/CPD, and to promote free movement of European medical specialists while ensuring the highest quality of medical care for Europeans.

Besides the still growing applications of internal vectorized therapy, the future (and present) of NM, considering its diagnostic use, is based on tracer principles (pico/nanomolar amounts of tracer) and the quasi-unlimited clinical field of radiopharmaceuticals.

Although molecular imaging is dependent on the radiotracer more than on the scanner, NM physicians should be adequately trained in cutting-edge techniques of hybrid imaging systems. These systems enable the display of the parametric, physiological, metabolic, molecular information provided by radiopharmaceutical imaging on the anatomical information provided by the cross-sectional images. Since CT information is mainly used as a tool to increase specificity and localization precision, hybrid imaging systems do not require state-of-the-art multidetector row CT used in radiology. The knowledge and skills required to successfully interpret three-dimensional anatomical information provided by hybrid imaging systems are currently gained in NM departments, as in France all hybrid imaging systems have been installed in NM departments since the beginning of the multimodality approach.

Although CT (via PET/CT and SPECT/CT) mainly provides anatomical data, MRI can supply some functional/molecular information in addition to a better soft tissue characterization. In contrast to NM, this information does not come from "probe" injection ("labelled" with either gadolinium or iron oxide), which would require the use of micro/millimolar amounts (i.e. too high to permit rigorous and harmless evaluation), but from the molecular environment in which the protons are located, therefore providing pathophysiological information as multiparametric imaging. PET/MRI is currently under development. The relative clinical usefulness of the data from PET and radiopharmaceuticals as compared to those drawn from MRI data using diffusion-weighted imaging, diffusion tensor imaging and blood oxygenation level-dependent (BOLD) imaging should be assessed within the next few years before this exciting but costly research tool can be implemented into clinical practice. If the superiority of this new hybrid technology were to be demonstrated, NM specialists would have to extend their learning and training in the MR field to be able to report the whole diagnostic content of the exam.

References

1. Prigent A, Huic D, Costa DC. Syllabus for Postgraduate Specialization in Nuclear Medicine—2011/2012 Update: nuclear medicine training in the European Union. Eur J Nucl Med Mol Imaging 2012;39:739–43.