GUIDELINES

Guidelines issued by the French Society of Cardiology concerning the competence, performance and environment required in the practice of diagnostic and interventional cardiac electrophysiology

Recommandations de la Société française de cardiologie concernant les conditions de compétence, d’activité et d’environnement requises pour la pratique de l’électrophysiologie diagnostique et interventionnelle

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Abbreviations: AF, atrial fibrillation; AV, atrioventricular; EP, electrophysiology.
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In view of the considerable progress made in recent years in the interpretation, diagnosis and treatment of cardiac arrhythmias, promoting endocardial ablation to the rank of first or second treatment choice for all types of tachyarrhythmias, whether atrial, junctional, or ventricular, it seemed necessary to revisit the 1994 [1] and 1999 [2] guidelines issued by the French Society of Cardiology regarding interventional cardiac EP.

By enabling the recording of endocardial electrograms, the measurement of myocardial refractoriness and the analysis of responses to electrical stimulation, intracardiac EP studies represent the primary means of accurately diagnosing rhythm disturbances, unravelling their mechanism(s) and judiciously identifying the treatment of choice — catheter ablation in particular. Interventional EP includes techniques that consist of detecting then eliminating arrhythmogenic sites, accessory pathways or abnormal conductive tissue, with a view to permanently eradicating a tachyarrhythmia or increasing the tolerability of recurrent or incessant tachyarrhythmias. The average procedural complexity varies with the type of targeted arrhythmia. It may be high in some cases due to a structural abnormality or to a complex anatomical location associated with higher risks or requiring the use of special diagnostic or therapeutic techniques. All of these underline the necessity of adequate competence of the responsible operators and a dedicated environment.

The aims of our guidelines are: to define the criteria that guarantee the quality of physician training and patient care, in terms of volume of procedures, institutional environment, medical and paramedical staff, technical equipment and instrumentation, and training centre characteristics; and to describe the conditions required to correctly apply these methods and attain their objectives while preserving patient safety. These recommendations are good practice advice and are not intended to be binding.

Diagnostic electrophysiology

Diagnostic EP includes all intracavitary recordings of cardiac electrical activity under baseline conditions and during electrical, pharmacological or other forms of stimulation; it is performed for diagnostic purposes, as a prognostic tool or in preparation for treatment [3–5].

Physicians’ training in cardiac electrophysiology

EP studies must be performed by board-certified cardiologists or trainees in cardiology. Besides the technical skills, a thorough knowledge of cardiology is needed to determine the procedural indications, mitigate the risk of complications and accurately interpret the data [6–8]. Physicians who completed their training before 2004 or who are currently training must have passed the theoretical and practical examinations in cardiac arrhythmias and pacing set by the Inter-University Board of Cardiac Electrophysiology and Pacing (diplôme inter-universitaire de rythmologie et de stimulation cardiaque) [9]. They must also have participated in ≥ 100 EP studies and acted as principal operator in ≥ 50 EP studies.

Features of a diagnostic cardiac electrophysiology centre

Medical and paramedical staff competency

The centre must be headed by a fully accredited cardiologist and the EP studies must be performed under the responsibility of a cardiologist who has completed the appropriate training, and with at least one registered nurse in attendance throughout the procedure. The staff must have been trained for ≥ 1 month in a centre specifically dedicated to the teaching of diagnostic EP.

Laboratory and technical instrumentation

The EP laboratory must fulfil the prevailing standards applicable to preserve the safety of patients and medical and paramedical staff, particularly with respect to radiological equipment and the observation of sterile techniques. The laboratory must also be designed to contain: an image intensifier, 18–23 cm in diameter image intensifier, with a movable C-arm and mobile table top; a computer-based recorder with at least six channels, three of which are dedicated to the recording of the surface electrocardiogram,
Interventional electrophysiology

Interventional EP consists of detecting by endocardial mapping, ablation (term widely used for ‘eliminating’) an arrhythmogenic myocardial area, accessory pathway or conduction tissue, with the goal to curing an arrhythmia or optimizing the tolerability of a recurrent or incessant tachyarrhythmia. Ablation is performed by delivering energy to the arrhythmogenic substrate via a catheter [10—21]. The diagnostic and therapeutic procedures are generally performed at the same time. While the procedural complexity usually depends on the targeted arrhythmia, complicated cases may be encountered due of a particular anatomical structure or localization, associated with specific risks or requiring special techniques.

Physicians’ training in interventional electrophysiology

Candidates for interventional EP accreditation must be board-certified in cardiology, have completed training in diagnostic EP, as defined earlier, and undergo ≥ 1 year of specific, full-time, practical training in interventional EP in a teaching centre, as part of or separately from the Inter-University Board of Cardiac Electrophysiology and Pacing. Physicians who trained before 2005 are recommended the equivalent of 2 years of full-time training in diagnostic and interventional EP in a teaching centre. Physicians who trained after 2004 or who are currently training must have passed the theoretical and practical examinations set by the Inter-University Board of Cardiac Electrophysiology and Pacing and completed 1 year of full-time training in interventional EP in a teaching centre. As required by the Inter-University Board, the candidates must have performed ≥ 50 ablation procedures as the primary operator and under the supervision of a certified trainer, including the slow AV pathway, the accessory AV pathway, atrial flutter and other atrial and ventricular arrhythmias, although not including ablation of the AV junction.

Physicians who perform ablation procedures must be able to manoeuvre the catheters to the cardiac arrhythmogenic zones, which implies a thorough knowledge of cardiac anatomy [22] and the completion of a learning curve [23—25]. Furthermore, the ablation of arrhythmogenic substrates located in the left cardiac chambers requires specific training in transseptal and retrograde transaortic catheterization procedures. Ablation of AF is associated with a higher risk of complications than other ablation procedures, with a clear correlation between complication rates and experience of the operator and medical centre [26—28]. Special technical training is, therefore, recommended, as well as a particular awareness of the specific complications associated with the procedure and their management in an emergency. Besides the number of ablation procedures recommended earlier, physicians in training must have performed ≥ 50 supervised AF procedures in a teaching centre.

The widespread application of endocardial ablation and its indications for increasingly complex substrates have stimulated major developments in new technology. In order to apply these state-of-the-art and developing technologies with maximum safety for the patient, operators must gather sufficient experience regarding the procedural indications, contraindications and particular risks associated with its implementation, acquired by training in expert centres and by attending and participating in dedicated continuing education sessions held during scientific meetings. Despite the anticipated simplification of procedures by recently achieved or upcoming technical advances, operators must acquire and maintain a broad knowledge of EP, which remains mandatory to the performance of all ablations, independent of technological refinements, and perform personally ≥ 30 ablation procedures/year as well as regularly participate in the continuing medical education offered at professional meetings dedicated to interventional EP.

Features of an interventional cardiac electrophysiology centre

Activities of a cardiac electrophysiology centre

The correlation between the number of ablation procedures performed in a medical centre and the complication rate has been confirmed by several studies [29,30]. Intracardiac ablation is a highly technical and mostly elective procedure that requires dedicated, hospital-based facilities. The delivery of care must be adapted to the need of the population and guarantee a high level of technical skill, reflected in high rates of procedural success and efficiency, and low rates of complications. The centres for interventional EP must
Guidelines on diagnostic and interventional cardiac electrophysiology

D. 6124-181 du Code de la santé publique

medical assistants, including at least one nurse (presence during all procedures of at least two trained para-

reanimation equipment are the same as those recommended

duration.

be available in sufficient numbers to complete the proce-
temperature. Finally, dedicated disposable catheters must

radiofrequency energy delivery systems must be officially approved for

recorders digitize and store the signals. In addition, the abla-

to preserve a stable electrocardiogram recording during

wich leads during pace-mapping and include special filters

intracardiac recordings to the 12 surface electrocardiograp-

three endocardial channels and one arterial pressure recor-

as those described for diagnostic EP, except that the EP

in case of complex procedures. A single, properly trained

cardiologist may perform the procedures in level 1 centres,

while at least two cardiologists trained in interventional EP

must staff the laboratories of level 2 centres. A trainee

may be the second operator in procedures staffed by two

cardiologists.

Paramedical staff

The requirements regarding the attendance and training of

nursing staff are those applicable to diagnostic EP.

Decree no. 2009-410, published on 14 April 2009 in the

Official Journal of the French Republic, defining the oper-

ating technical conditions applicable to imaging-assisted,

intracardiac, interventional procedures [31], specifies the

presence during all procedures of at least two trained para-

medical assistants, including at least one nurse (Article

D. 6124-181 du Code de la santé publique).

Facilities and technical equipment

The safety features and radiological equipment are the same

as those described for diagnostic EP, except that the EP

recorder must offer at least 12 channels, including at least

three endocardial channels and one arterial pressure recor-

ding channel. The system must enable the rapid switch from

intracardiac recordings to the 12 surface electrocardiogra-

phic leads during pace-mapping and include special filters

to preserve a stable electrocardiogram recording during

the delivery of radiofrequency energy. Currently available

recorders digitize and store the signals. In addition, the abla-

tion energy delivery systems must be officially approved for

commercial use and operated according to the manufactur-

ers’ instructions. Radiofrequency energy delivery systems

must continuously monitor impedance, delivered energy and

temperature. Finally, dedicated disposable catheters must

be available in sufficient numbers to complete the proce-

dure.

The specifications of the programmable stimulator and

reanimation equipment are the same as those recommended

for diagnostic EP procedures. A readily accessible log of all

ablation procedures must be kept regularly.

Supplemental hospital-based resources

Anaesthesia

General anaesthesia might have to be induced during an

ongoing interventional EP procedure because of pain, dis-

comfort or prolonged duration. An anaesthesiologist must

hence be immediately available.

Surgical coverage

Because major complications of cardiac ablation might

require urgent cardiothoracic or vascular surgery, surgical

coverage must be planned and detailed in a protocol jointly

written by the EP interventional team and a qualified

surgical team. The specific risk of tamponade implies the

possibility to proceed with pericardial drainage at any time

during the procedure, by a physician familiar with the tech-
nique or by a surgeon on stand-by in the medical centre.

During AF ablation, surgical coverage must be available

immediately to handle with life-threatening complications.

Intensive care

A cardiac intensive care unit located near the interventional

EP laboratory is indispensable for monitoring patients after

complex or complicated procedures.

Features of an interventional cardiac electrophysiology training centre

Besides the features of a level 2 centre described earlier,

interventional EP training centres must perform ≥ 150 abla-
tion procedures yearly, implant pacemakers, cardioverter

defibrillators and cardiac resynchronization therapy devi-
ces, and conduct regular reviews of cases and internal
didactic meetings.

Disclosure of interest

The authors declare that they have no conflicts of interest

concerning this article.

References


good practice of intracavitary techniques for diagnosis and

treatment of cardiac arrhythmia. Diagnostic electrophysiology;

interventional electrophysiology; permanent cardiac stimula-
tion; implantable automatic defibrillators. Arch Mal Coeur Vaiss


diagnostic and interventional electrophysiology, permanent

cardiac pacing and implantable automatic defibrillation. Arch


trophysiological investigation of tachycardia. Arch Mal Coeur