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ACP/ACC/AHA TASK FORCE STATEMENT

Clinical Competence in Invasive Cardiac Electrophysiological Studies

ACP/ACC/AHA Task Force on Clinical Privileges in Cardiology

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The granting of clinical staff privileges to physicians is one of the primary mechanisms used by institutions to uphold the quality of care. The Joint Commission on Accreditation of Healthcare Organizations requires that the granting of initial or continuing medical staff privileges be based on assessments of applicants against professional criteria that are specified in the medical staff bylaws. Physicians themselves are thus charged with identifying the criteria that constitute professional competence and with evaluating their peers accordingly. Yet the process of evaluating a physician's knowledge and competence is often constrained by the evaluator's own knowledge and ability to elicit the appropriate information, problems that are compounded by the growing number of highly specialized procedures for which privileges are requested.

This recommendation is one in a series developed by the American College of Physicians, the American College of Cardiology, and the American Heart Association to assist in the assessment of physician competence on a procedure-specific basis. The minimum education, training, experience, and cognitive and technical skills necessary for the competent performance of invasive cardiac electrophysiological studies (EPS) are specified. Whenever possible, these specifications are based on published data linking these factors with competence or, in the absence of such data, on the consensus of expert opinion. They are applicable to any practice setting and can accommodate a number of ways physicians might substantiate competence in the performance of specific procedures (see also Guide to the Use of ACP Statements on Clinical Competence (*Ann Intern Med* 1987;107:588–589). The recommendations listed here are only for routine invasive electrophysiological studies and do not address the training and expertise needed for competence in intraoperative tachycardia mapping, evaluation of antitachycardia devices, or catheter ablative procedures for tachycardia control. Credentials committees of individual hospitals may need to develop their own criteria in consultation with appropriate experts for authorizing the use of these and other new procedures.

Overview of the Procedure

The initial His bundle recording was reported in 1969 by Scherlag et al (1). Its value as a useful tool for assessing the site of atrioventricular (AV) delay and block as well as for determining the origin of premature beats and tachycardias was quickly established. At about the same time, programmed electrical stimulation was used to initiate supraventricular tachycardia (SVT) in patients without ventricular preexcitation (2). Later, induction of SVT was also demonstrated in Wolff-Parkinson-White syndrome (3). The ability to record intracardiac electrical signals from various sites and reproduce clinical tachycardias as well as sinus and AV conduction abnormalities made invasive EPS clinically useful. Due to the episodic and hence elusive nature of cardiac arrhythmias, the techniques of invasive EPS and programmed electrical stimulation have become a logical part of the workup of patients with rhythm problems. This is

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not surprising, as sound clinical decisions can seldom be made if the underlying arrhythmia cannot be documented. It may be necessary to replicate the arrhythmia if it is not demonstrated at the time of medical evaluation.

Rationales for the recommendation of clinical electrophysiological procedures range from purely diagnostic to therapeutically curative. The value of EPS has increased over the years and such studies are now considered useful in the treatment of patients with a wide variety of arrhythmias.

In this report the term "EPS" refers both to the recording of intracardiac electrical signals and programmed electrical stimulation. A detailed description of EPS is beyond the scope of this document, but the procedure is briefly outlined below.

Using venous (and occasionally arterial) access, electrode catheters are positioned in various intracardiac locations with the help of fluoroscopy. The signals recorded via these electrode catheters are important for precise timing of electrical events to assess the location and direction of impulse propagation. The latter requires several points of recording to determine the activation sequence, a process frequently called "mapping." The usual sites of placement are the right and left atria (via coronary sinus), His bundle, and right ventricle.

Since most arrhythmias are transient, they are unlikely to be spontaneously present at the time of study. Programmed electrical stimulation is needed to replicate clinical arrhythmias and/or conduction abnormalities as well as to induce other clinically significant abnormalities of cardiac rhythms. Once an arrhythmia is induced electrically, reinduction can be attempted following administration of antiarrhythmic drugs or use of other interventions (eg, catheter ablation) to determine efficacy of intervention. Intravenous pharmacological agents (such as isoproterenol, procainamide, and adenosine) are often administered to facilitate tachycardia induction, unmask conduction abnormalities, or predict drug responses.

In the earlier days EPS primarily played a diagnostic role and was often used to assess sinus node function and to study the site of AV block (4–7). Currently EPS is performed in patients with bradycardia when there is doubt about the exact nature of the problem and whether permanent pacing is indicated and at what mode. Early SVT studies focused on induction, termination, mechanisms, and site of origin (2,3,8–12). Subsequently, programmed electrical stimulation was suggested as a means of guiding pharmacological therapy in patients with inducible SVT (13). Pharmacological intervention that rendered an inducible sustained tachycardia to noninducibility suggested a favorable therapeutic effect (13). Ability to reproducibly induce clinical SVT also led to the introduction of various nonpharmacological means of achieving therapeutic control, the most recent being the catheter ablative techniques (14–17).

The role of EPS in patients with ventricular tachycardia–ventricular fibrillation (VT-VF) has also undergone significant evolution (18–24). At the present time such patients are studied to determine the exact nature of wide QRS tachycardia, to assess the efficacy of pharmacological therapy, and to select patients for nonpharmacological treatments such as VT surgery, catheter ablation, and implantable cardioverter defibrillator and antitachycardia devices, including those with backup defibrillation capabilities. EPS will probably be used increasingly for the assessment of risk of serious arrhythmic events and hence as a method for risk stratification (25,26).

Physicians involved in performing invasive EPS should be aware of its indications, contraindications, and complications to properly assess the risks and benefits of EPS in a given patient (27–29). The absolute contraindications are few and include situations such as critical disease of the left main coronary artery, unstable angina, bacteremia/septicemia, fulminant congestive heart failure (not caused by arrhythmias), major bleeding diathesis, and deep vein thrombosis if femoral vein cannulation is desired. However, the physician should also use extreme caution in clinical settings in which the patient is not considered stable (eg, hemodynamic instability, electrolyte acid-base imbalance) or is otherwise unable to tolerate the procedure.

In the vast majority of situations, EPS is performed on an elective basis, usually for chronic problems. Risks can be high when EPS and/or programmed electrical stimulation are performed on an urgent basis, and such risks are justifiable only if the arrhythmia is the main or the major cause of the emergency, as in incessant VT.

The complete list of indications is detailed in the ACC/AHA task force document on guidelines for clinical intracardiac EPS (29).

Justification for Recommendations

The indications, contraindications, and recommendations for the minimum education, training, experience, and skills necessary to perform EPS are principally derived from the opinion of the ACP/ACC/AHA Task Force on Cardiology of the American College of Physicians' Clinical Privileges Project.

Expertise in invasive EPS requires not only the ability to safely perform the cardiac catheterization necessary for intracardiac recording and cardiac stimulation but also a thorough understanding for correct interpretation of gathered data. The latter in particular requires an ongoing effort to stay abreast in this rapidly evolving field. Such effort is essential for accurate diagnosis and prognostication as well as application of state-of-the art therapy. As knowledge has increased, the interpretation of data acquired in the electrophysiology laboratory has become increasingly complex. The quality of diagnostic information forms the basis for a given therapeutic approach. The gathering of interpretable data is particularly critical in the selection of nonpharmacological therapy, a practice that seems to be gaining wider acceptance in patients with both SVT and VT. It therefore

Table 1. Some Technical Skills Needed to Perform EPS

Operational skills to perform right heart catheterization using percutaneous technique via femoral and other venous access sites
Manual dexterity to safely place electrode catheters in right and left (coronary sinus) atria, right ventricle, and atrioventricular junction
Ability to obtain appropriate recordings from various locations
Ability to safely perform programmed electrical stimulation
Ability to recognize and manage procedural complications (eg, vascular or cardiac perforation)
Proficiency in the use of external defibrillation and intravenous cardiac medications
Technical knowledge regarding the use of recording equipment, including knowledge of electrical safety and pertinent radiation-related issues

EPS indicates electrophysiological studies.

seems justifiable to establish some minimal criteria for technical and cognitive skills to meet the contemporary standards of care. Except in unusual situations, such skills are likely to be acquired through formal training.

Minimum Training Necessary for Competence

To acquire the cognitive and procedural skills required by clinical EPS, a minimum of 1 year of specialized training in EPS is needed (30–33). This training should be in a center with an adequate volume of cases and a recognized training program in clinical electrophysiology. This formal training is in addition to completion of a formal cardiology fellowship in an approved cardiology program. The training requirements, both in cardiology and cardiac electrophysiology, should be in line with the recommendation made by the American Board of Internal Medicine (34). It is recommended that each trainee should be a primary operator and analyze 100 baseline diagnostic procedures. The trainee's experience should be documented in writing and confirmed by the supervisor. For each performance during the training period the following facts should be documented: date, patient identifying number, patient age, indication for the procedure, findings, complications, and signature of the supervisor.

One year's training in clinical electrophysiology may be adequate for routine EPS, but a second year's training is desirable for those who wish to be competent in nonpharmacological intervention techniques for the treatment of patients with both SVT and VT-VF (31). These include catheter and surgical ablative techniques and implantable antitachycardia, cardioverter, and defibrillation devices. The appropriate minimum standards for technical and cognitive skills are outlined in Tables 1 and 2.

Alternate Routes for Achieving Competence

In the absence of formal 1-year training, competence in clinical electrophysiology is difficult to ascertain. Nonetheless, it is conceivable that in exceptional circumstances some individuals with prior experience in arrhythmia management could acquire the necessary cognitive and procedural skills shorter time. This period of formal training in clinical electrophysiology should not, however, be less than 6 months for individuals who finished their formal training before 1992. Satisfactory completion of such training should be documented in a log by a recognized expert in the field of cardiac electrophysiology who has served as the responsible mentor. It is highly desirable that such individuals should meet the following additional criteria:

1. Perform a minimum of 100 EPS procedures as the primary operator during the period of training
2. Participate in courses designed to provide specific instruction in cardiac EPS. A minimum of 30 hours of continuing medical education (category I) is desirable.

Individuals trained before 1980, when few training opportunities existed, need not have received formal training. However, these individuals should have acquired the knowledge and skills equivalent to those described above.

Table 2. Some Cognitive Skills Needed to Perform EPS

Knowledge of current indications
Knowledge of contraindications
Knowledge of complications and management of such complications
Knowledge of normal and abnormal cardiac anatomy and physiology
Knowledge of the anatomy and physiology of the normal atrioventricular conduction system and accessory pathways
Ability to measure conduction intervals and refractory periods and knowledge of their significance in functional and pathological states
Understanding of the intracardiac electrocardiographic signals
Knowledge of various methods of programmed electrical stimulation
Knowledge of sensitivity and specificity of EPS testing in various arrhythmias and clinical syndromes
Ability to interpret data derived from electrophysiologic testing
Knowledge of pharmacology of antiarrhythmic drugs

EPS indicates electrophysiological studies.

Maintenance of Competence

Like many other procedures, a minimum number of cases is necessary to ensure quality of care. This is a critical issue both for the institution and the operator. The individual should perform at least 100 procedures per year to maintain skills and should attend at least 30 hours of formal continuing medical education (level I category) instruction every 2 years to remain abreast of changes in technologies and knowledge.

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