
ACP/ACC/AHA TASK FORCE STATEMENT

Clinical Competence in Insertion of a Temporary Transvenous Ventricular Pacemaker**ACP/ACC/AHA Task Force on Clinical Privileges in Cardiology****LEAD AUTHOR****GARY S. FRANCIS, MD, FACC****TASK FORCE MEMBERS****SANKEY V. WILLIAMS, MD, FACP, Chairman****JAMES L. ACHORD, MD, FACP****WILLIAM A. REYNOLDS, MD, FACP****CHARLES FISCH, MD, FACC****GOTTLIEB C. FRIESINGER II, MD, FACC****FRANCIS J. KLOCKE, MD, FACC****MASOOD AKHTAR, MD, FACC****THOMAS J. RYAN, MD, FACC****ROBERT C. SCHLANT, MD, FACC**

The selective 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 on the basis of such criteria. 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 temporary transvenous ventricular pacemaker insertion are specified. Whenever possible, these

specifications are based on published data linking these factors with competence in certain procedures or, in the absence of such data, on the consensus of expert opinion. They are applicable to any practice setting and can accommodate a variety of pathways physicians might take to attain competence in the performance of specific procedures (see also Guide to the Use of ACP Statements on Clinical Competence. *Ann Intern Med.* 1987;108:588-589).

Overview of the Procedure

Temporary transvenous endocardial pacing was first described by Furman and Robinson (1) in 1958, and the list of clinical indications has now expanded to include the management of bradycardia (2), tachyarrhythmias (3), and other conduction system disturbances (4). The purpose of temporary transvenous pacemaker insertion is to maintain circulatory integrity by providing for standby pacing should sudden complete heart block ensue, to increase heart rate during periods of symptomatic bradycardia, and occasionally to control sustained supraventricular or ventricular tachycardia.

Whether ventricular or atrioventricular (AV) pacing should be used depends on hemodynamic considerations. Performance of AV temporary pacing requires additional experience and can be considerably more difficult from a technical standpoint. Therefore, only insertion of the ventricular type of temporary transvenous pacemaker is considered here, with the recognition that differentiating ventricular from dual-chamber pacing systems is somewhat arbitrary. It is important to stress that simple right ventric-

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ular pacing may compromise hemodynamic status even when it is functioning normally, such as might occur during right ventricular infarction, with hypertrophied noncompliant ventricles, and during "pacemaker syndrome." Thus, physicians should be able to recognize when the pacing mode is inappropriate and when a change to dual-chamber pacing mode will benefit the patient.

Since temporary pacemakers are manufactured by many different vendors, physicians credentialed to insert temporary pacemakers should be familiar with the insertion equipment, leads, and the external generator used in their own hospitals. Physicians trained in one institution but practicing in another may find the equipment sufficiently different to require special orientation. Although equipment setup, troubleshooting, and other technical details can be managed by nursing or technical personnel, the integrity and interpretation of data are always the physician's responsibility. The physician should be knowledgeable about the equipment setup and technical data of the system, as this will affect its proper function should a problem arise.

Careful patient follow-up to avoid complications and to determine suitability for implantation of a permanent pacemaker is an integral part of the responsibility of the physician who performs the procedure.

The physician should be knowledgeable about the normal morphology of the endocardial electrograms of the superior vena cava, right atrium, and right ventricle to ensure the accurate use of electrocardiographic monitoring as a guide to lead positioning. The physician should be able to distinguish artifacts from genuine electrocardiographic data and therefore must assume responsibility for the integrity of the data and its use in treatment of patients. Understanding the indications for insertion as well as competence in using the pacemaker to treat the patient are critical; such competence requires greater training, experience, and judgment than basic knowledge of the technical aspects of pacemaker insertion can confer.

Justification for Recommendations

The indications, contraindications, and recommendations for the minimum education, training, experience, and skills necessary to perform temporary pacemaker insertion are principally derived from the opinion of the ACCP/ACC/AHA Task Force on Cardiology of the American College of Physicians' Clinical Privileges Project. Privileges to perform this procedure should be granted on an individual basis because several disciplines (including cardiology, thoracic and cardiovascular surgery, critical care, emergency medicine, and anesthesiology) are involved in training and performing the procedures, and the pathways to competence are varied. Many physicians who were recently certified in subspecialties such as cardiology, pulmonary medicine, anesthesiology, and critical care medicine have received supervised training that exceeds requirements. Other physicians in these subspecialties and physicians from other

training programs, such as internal medicine or family medicine, may need to make special arrangements with the program director to acquire the breadth of training required for competence.

Recommendations on maintenance of competence are based on the expert opinion of the ACCP/ACC/AHA Task Force on Cardiology of the American College of Physicians' Clinical Privileges Project.

Indications, Contraindications, and Complications

The following examples were carefully considered when these guidelines were developed and provide some insight into the range of cognitive material that the applicant should master. Such a list may be modified by clinical judgment about individual patients and advances in medical practice and should not be considered complete nor exhaustive. For some patients with acute myocardial infarction and conduction system disorders, the benefit of temporary pacing is possible but not proven. In these cases and in the cases outlined below, clinical judgment is the key to appropriate use of the procedure. Hazards, inconvenience to the patient, and expense of the procedure are also important considerations.

Some common indications (5) for temporary pacemaker insertion within the context of acute myocardial infarction include acquired complete heart block or Mobitz type II AV block. Indications for temporary pacemaker insertion outside the context of acute myocardial infarction include complete heart block caused by structural heart disease and symptomatic sinus bradycardia or prolonged sinus pauses longer than 3 through 4 seconds. Other indications may include selected tachyarrhythmias such as torsades de pointes associated with structural heart disease, metabolic abnormalities, and drug side effects. In these contexts temporary transvenous pacing is often performed to relieve symptoms and sometimes precedes implantation of a permanent pacemaker.

Contraindications to the procedure are relatively few and include the patient's inability to cooperate or lack of therapeutic benefit because of advanced disease.

The clinician must be able to knowledgeably choose between the need for temporary transvenous pacemaker versus simple observation or the possible use of an external (eg, cutaneous) cardiac pacemaker (6). Such decisions are not always straightforward despite extensive attempts to determine which conduction disorders are most likely to lead to complete heart block (4,7-11). For example, in acute myocardial infarction the reported incidence of complete heart block preceded by conduction system disturbances such as isolated right bundle branch block varies from 0% (9) to 37% (12). A definitive controlled trial to clarify the indications for temporary transvenous pacing in patients with acute myocardial infarction is unlikely because of

Table 1. Some Cognitive Skills Needed to Perform Temporary Pacemaker Insertion

Knowledge of indications, with emphasis on the subtleties involved
Knowledge of electrocardiographic data, including endocardial electrograms
Knowledge of the anatomy of the neck, central venous system, peripheral arterial tree, heart, and lungs
Knowledge of and ability to recognize the various forms of conduction disturbances and arrhythmias for which the procedure is indicated, especially in the setting of acute myocardial infarction
Understanding the importance of and ability to recognize artifacts and the clinical circumstances under which data may be misleading and/or difficult to obtain
Knowledge of fluid and electrolyte balances and their roles in altered cardiac conduction
Knowledge of the pharmacological effects of the drugs that alter cardiac conduction and knowledge of the effects of certain drugs on pacing threshold
Knowledge of the complications of temporary pacemaker insertion and appreciation of the approaches and techniques necessary to minimize their occurrence, recognize their presence, and treat them promptly
Knowledge of the interaction of multiple pathophysiological states and diseases that are present in many critically ill patients undergoing temporary pacemaker insertion
Knowledge of how to determine capture and sensing "thresholds"
Knowledge of pacemaker system dysfunction (including failure to capture and sense the R wave properly)
Ability to communicate the results of the procedure to the patient and other physicians and to document them for the medical record

ethical considerations and the relatively uncommon occurrence of conduction system disturbances in this setting. Transvenous temporary pacing probably improves survival in only a small fraction of patients, eg, patients with complete AV block and anterior wall infarction. The prognosis of intraventricular conduction defects is probably related more to the extent of myocardial injury than to the direct consequences of the block itself (13).

Every physician who inserts temporary pacemakers should be familiar with potential complications and their prevention. Several approaches to the central venous system have been reviewed, including percutaneous puncture of the internal jugular vein, (14,15) subclavian vein (16,17), and femoral vein (18-20) or a cut-down approach to the antecubital vein (21).

Most complications are infrequent and usually minor. Life-threatening complications are rare. Minor complications such as nonsustained arrhythmias and local phlebitis are common, but accurate data on their frequency are not available. The major determinants of the rate of complications are the urgency of the procedure, the severity of the illness, and the expertise of the operator.

Pacing system dysfunction, an important complication, is reported to occur in 18% (22) to 43% (23) of cases. This includes failure to capture or sense the R wave properly. System malfunctions are usually due to problems with connections and lead placement or inappropriate setup of the device.

Trans thoracic pacemakers may have some role in the

patient with bradyarrhythmic and asystolic arrest. With the development of more effective external pacing system in recent years (6), the role of trans thoracic pacing in such circumstances must be reevaluated.

Minimal Training Necessary for Competence

The varied training of physicians who perform temporary transvenous pacemaker insertion makes the role of the hospital credentials committee critical. The specific number of procedures needed in a training program to acquire the necessary cognitive and technical skills for temporary pacemaker insertion (see Tables 1 and 2) will vary depending on the aptitude and dexterity of the physician, the clinical and institutional setting in which the training occurs, and the backup and collaboration available to the physician. Competence in hemodynamic monitoring requires a minimum of 25 procedures (24). It is the view of the task force that competence in hemodynamic monitoring with balloon flotation devices is a prerequisite to competence in insertion of a temporary transvenous ventricular pacemaker. Thus, performance of a minimum of 10 temporary transvenous ventricular pacemaker procedures is required. For physicians who learn the technique outside a residency or fellowship program, there may be other pathways to competence, such as preceptorships in which a trainee without prior competence in hemodynamic monitoring becomes familiar with all aspects of temporary pacemaker insertion and performs at least 25 procedures during the allotted time frame.

Table 2. Some Technical Skills Needed to Perform Temporary Pacemaker Insertion

Ability to adhere to surgical sterile technique
Ability to perform venous access from two (or multiple) sites with the percutaneous technique; ability to do cut-downs is also desirable
Ability to perform right heart catheterization
Ability to operate all instrumentation involved, including pacing catheters, introducers, and recorders
Ability to correct ("troubleshoot") technical problems with placement instrumentation and pacing catheters
Ability to obtain sufficient and high-quality data

The cognitive and technical skills of the candidates should be confirmed in writing by the training director; in some cases, verification or clarification through follow-up correspondence with the program director or observation of the physician performing the procedure by a staff physician who is an acknowledged teacher or expert in temporary pacemaker insertion may be required. Each physician in training should keep a log of procedures done. The log should include patient identification, date, diagnosis, indication, problems and complications, duration of monitoring, and the signature of the supervisor.

The completion of a short course or workshop that offers limited exposure to cognitive background data or technical skills will not by itself result in competence.

Although many physicians acquire the cognitive and technical skills needed for temporary pacemaker insertion during the course of a fellowship or residency program, completion of a fellowship in and of itself does not guarantee competence. Some fellowship programs do not specifically teach temporary pacemaker insertion. Although such programs may provide an overall experience with temporary transvenous pacemaker insertion that might contribute to competence in this procedure, lack of direct experience with temporary transvenous pacemaker insertion during the program precludes competence. Because people learn at different rates, granting of privileges should be based on a careful assessment of each applicant's skills.

Maintenance of Competence

Follow-up of each physician's performance and timely review of patient outcomes is important. Many hospitals make these assessments by having the physician who performs the procedure fill out a simple form for the patient's record. An alternative approach is to include a comprehensive procedure note in the body of the chart that could then be submitted to the credentials committee on a timely basis for review and documentation. In addition, each physician should keep a log of procedures done, including indications, complications, and duration of monitoring.

Maintaining competence in temporary pacemaker insertion requires continuing experience and will depend on the physician's total experience and the hospital setting in which practice occurs. Physicians with extensive experience who work in hospitals in which these procedures are done infrequently may be able to maintain competence with a minimum number of continuing procedures, perhaps as few as one or two per year, provided that they maintain their technical skills in balloon flotation for hemodynamic monitoring and update their cognitive skills as knowledge evolves (24).

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