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# *AHA/ACC/ACP Task Force Statement*

## *Special Report*

### **Clinical Competence in Elective Direct Current (DC) Cardioversion**

#### **A Statement for Physicians From the AHA/ACC/ACP Task Force on Clinical Privileges in Cardiology**

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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 the 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 base and ability to elicit the appropriate information, a problem that is compounded by the growing number of highly specialized procedures for which privileges are requested.

This recommendation is one in a series developed to assist in the assessment of physician competence on a procedure-specific basis. The minimal education, training, experience, and cognitive and technical skills necessary for the competent performance of direct current (DC) cardioversion are specified; whenever possible, these are based on published data linking these factors with competence in certain procedures and, 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 competence in the performance of specific procedures (see also "Guide for the Use of American

College of Physicians' Statements on Clinical Competence," *Ann Intern Med.* 1987;107:588-589).

#### **Overview of the Procedure**

Direct current cardioversion is a treatment for cardiac arrhythmias that uses a brief and calibrated discharge of electricity across the heart.<sup>1</sup> The discharge depolarizes the entire heart, eliminating an abnormal rhythm and permitting the sinoatrial node to resume control. The shock is delivered across the chest wall by means of two external electrodes. By electronically monitoring the patient's cardiac rhythm, it is possible to deliver the discharge at a safe point in the cardiac cycle, avoiding the so-called vulnerable period of the ventricles. Indeed, ensuring that the equipment is adjusted to deliver the depolarizing shock at the right instant is a key technical point. The term *cardioversion* refers to this precisely timed delivery of electricity to convert organized (although abnormal) cardiac rhythm, as distinguished from high energy electrical shock used to treat ventricular fibrillation. The latter maneuver, properly termed *defibrillation*, will not be considered here. Cardioversion is carried out with the patient under brief general anesthesia or sedation, to eliminate discomfort associated with transthoracic shock.<sup>2-4</sup>

Adjunctive use of prior warfarin therapy and concurrent use of antiarrhythmic agents are important considerations in the application of cardioversion.<sup>5</sup> For the great majority of subjects undergoing elective cardioversion for atrial fibrillation of >48 hours' duration, warfarin therapy is recommended for at least 3 weeks before and 4 weeks after the procedure. This is believed to reduce the possibility of systemic embolization from a recently formed and loosely adherent left atrial thrombus. The dose of warfarin should be adjusted to produce an International Normalized Ratio (INR) of 2.0 to 3.0 (corresponding to prolongation of prothrombin time, as assessed by conventional rabbit brain thromboplastin method, to 1.4 to 1.5 times control value). In patients deemed to be at high risk for embolization (those with a history of a prior embolic episode or with mechanical prosthetic heart valves), an INR of 3.0 to 4.5 (corresponding to a prothrombin time ratio of 1.5 to 2.0 times

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control value) should be maintained. Warfarin therapy is not indicated for other arrhythmias, including atrial flutter.<sup>6</sup>

The use of antiarrhythmic agents before and after cardioversion remains controversial.<sup>7,8</sup> Most information is available about quinidine. Patients on long-term digoxin therapy, without clinical evidence of digitalis toxicity, should continue to take this agent through the day before the procedure.<sup>9</sup> If there is clinical evidence of digitalis toxicity, the serum digoxin level should be checked, the procedure delayed, and the maintenance dose adjusted downward. The continued use of antiarrhythmic agents for long periods after cardioversion is also controversial. These agents appear to be of most value during the 3 months after successful conversion to normal rhythm. The subject of adjunctive drug therapy is addressed in References 7 and 8.

A brief description of the sequence of steps involving cardioversion serves as a useful prelude to specifying requisite cognitive and technical skills. Elective cardioversion should be preceded by assessment of the cardiac and metabolic state of the patient. Serum electrolyte values, particularly serum potassium values, should be normal. Knowledge of renal function (reflected in serum creatinine levels) guides the dosage of adjunctive medications. The serum digoxin level should be in the nontoxic range. When possible, the patient should be in optimal functional status at the time of the procedure. Arterial blood gas studies may be relevant in patients with chronic lung disease. Written informed consent should be obtained from the patient after appropriate discussion of the procedure.

The patient should be in the fasting and postabsorptive state. The procedure is usually carried out in an area suitable for intravenous administration of a general anesthetic or sedative agent and for conduct of cardiopulmonary resuscitation, if necessary. Equipment for treatment of severe and clinically significant bradyarrhythmias should be available, and agents for treatment of malignant ventricular arrhythmias should be on hand. A 12-lead electrocardiogram (ECG) is recorded and a secure intravenous cannula inserted. Monitoring leads are attached in the standard manner, and a technically acceptable display of the patient's rhythm should be shown on the monitor screen. The electronic equipment is adjusted to display a timing artifact for delivery of the electrical discharge at the proper point on the QRS complex. It may be necessary to vary the monitor lead to ensure that the circuit properly senses the R wave and not the T wave of the ECG signal.

Because several manufacturers produce equipment for performing cardioversion, the available device may differ from the one for which the physician received training. It is important that the physician become thoroughly familiar with the current device before attempting the procedure. The patient should be anesthetized or sedated by a qualified physician. When a satisfactory degree of anesthesia or sedation has been obtained, the capacitor is charged, usually to a range of 75 to 100 J. Onlookers are cautioned to stand back, avoiding contact with the patient as the shock is delivered. If available, pre-gelled adhesive electrode pads may be used as an alternative to paddle electrodes. If paddle electrodes are used, they are applied to the chest wall in one of the two standard positions (anteroposte-

rior or base and apex), and the activation button is triggered to deliver the shock. Emphasis should be placed on firm electrode contact through a good conducting medium to avoid arcing or burn. Immediately after the shock, the patient's rhythm is inspected on the monitor screen and then verified on a recorded ECG. If the arrhythmia persists, a satisfactory level of general anesthesia or sedation is reaffirmed or reattained. The shock is repeated at a high energy level until either normal rhythm is restored or a decision is made to abandon further attempts. In the unlikely event that ventricular fibrillation follows the shock, the equipment is switched to the nonsynchronized mode and a defibrillating countershock of 300 J is delivered across the thorax. All events should be recorded.

After the procedure, a 12-lead ECG is performed to document stability of the patient's QRS-T pattern (absence of evidence of injury). The patient is then monitored for at least 1 hour in a suitable area to ensure stability of rhythm and blood pressure.

Tables 1 and 2 list the requisite cognitive and technical skills for these procedures.

### Justification for Recommendations

The procedure of cardioversion has been in widespread use for more than 25 years. The technique of the procedure is not complex and has been well described in many publications.<sup>1,10</sup> The information in these guidelines about indications, contraindications, and complications has been drawn from an exhaustive survey of the English-language literature since 1962. General agreement exists about indications for the procedure. Cardioversion is highly effective in the treatment of atrial flutter and ventricular tachycardia and effective in initially reverting atrial fibrillation in >95% of patients.

Paradoxically, questions of training in the procedure, certification and maintenance of competence have not been previously addressed. To remedy this defect, a survey by mail was made to directors of the 225 currently accredited cardiology training programs (Yurchak P. Unpublished data, available from the author at Cardiac Unit/Massachusetts General Hospital, Boston, MA 02114). In addition, selected authorities on the subject of cardioversion and in the area of cardiac electrophysiology were interviewed by telephone.

Recommendations for the minimal training necessary for competence and for maintenance of competence reflect analysis of responses from these sources and the expert opinion of the AHA/ACC/ACP Task Force on Cardiology of the American College of Physicians' Clinical Privileges Project.

### Indications, Contraindications and Complications

The following *indications*, which were considered important when these guidelines were developed, outline the range of cognitive material that the applicants should master. These lists are not all-inclusive and may be modified by clinical judgment in individual patients by advances in medical practice.

*Cardioversion on an elective basis* (within a few weeks) is generally performed in patients who have atrial fibrillation or flutter with significant and distressing symptoms or reentrant tachycardia with significant symptoms that is resistant to therapy. It is also performed in asymptomatic patients with atrial fibrillation

**TABLE 1. Some Cognitive Skills Needed to Perform Cardioversion**


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A. Ability to recognize
1. The arrhythmias for which cardioversion is indicated and contraindicated
2. Postcardioversion rhythms, especially life-threatening arrhythmias (ventricular tachycardia and fibrillation, profound bradycardia)
3. Technically satisfactory monitor display of the patient's rhythm, free of artifact and showing proper location of the synchronization artifact
4. Post-reversion ECG evidence of myocardial damage on a 12-lead ECG
B. Knowledge of
1. Electrophysiologic principles underlying DC cardioversion
2. Indications for the procedure and degree of urgency
3. Conditions in which cardioversion is likely to be hazardous, unsuccessful, or inappropriate
4. Complications and their management
5. Appropriate dose and administration of sedative and analgesic agents, if these agents are to be used
6. Adjunctive use of anticoagulant and antiarrhythmic agents, avoidance of digitalis toxicity
7. Operation of equipment used for cardioversion, including proper synchronization of electrical discharge
8. Energy level appropriate for the various arrhythmias and incremental settings if the arrhythmia fails to revert
9. Proper skin preparation and placement of the external electrodes
10. Principles of Advanced Cardiac Life Support
11. Indications for and application of external pacing for treatment of significant postcardioversion bradycardia
C. Ability to explain
1. Purposes, benefits, and possible complications of the procedure to the patient so that appropriate informed consent can be obtained

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in whom long-term warfarin therapy is contraindicated or is rejected by the patient.

*Cardioversion on an urgent basis* (within 15 min) is generally performed in patients with supraventricular arrhythmias with ongoing anginal pain from coexistent coronary disease or hemodynamic compromise; atrial fibrillation with rapid ventricular response in patients with Wolff-Parkinson-White syndrome; or ventricular tachycardia after failure of intravenous administration of antiarrhythmic agents.

*Cardioversion on an emergency basis* (immediately) is generally performed on patients with tachyarrhythmia of any type that induces loss of consciousness and profound hypotension.

Some conditions in which cardioversion is likely to be hazardous, unsuccessful or inappropriate include presence of definite or suspected digitalis toxicity, hypokalemia, multifocal atrial tachycardia, and known sinus node dysfunction marked by alternation of supraventricular arrhythmias with periods of profound bradycardia. Major complications may include serious or fatal arrhythmias, myocardial damage, and acute pulmonary edema; minor complications include skin burns and transient hypotension.<sup>10</sup>

#### Minimal Training Necessary for Competence

Training must result in the acquisition of the cognitive skills outlined in Table 1 and the technical skills outlined

in Table 2. Competence in interpretation of ECGs is a prerequisite for clinical competence in cardioversion. The technical skills—application of electrodes, triggering the discharge, and so forth—are simple and easily mastered. Thus, the technical performance of the procedures is less important than familiarity with the routine and knowledge of the indications, contraindications, and complications. These cognitive points are reinforced with each cardioversion witnessed. The Task Force recommends participation in a minimum of eight supervised cardioversions to achieve competence in the necessary cognitive and technical skills. Along with this, didactic presentation of material and collateral reading from a selected bibliography are necessary for competence in cognitive skills. Most important, any physician performing elective cardioversion should be competent to handle any sequel to the procedure, including resultant arrhythmias or asystole.

While learning to perform the procedure a trainee must be supervised directly by an effective teacher who is expert in the clinical use of cardioversion and who carries out this role on an ongoing basis. The trainee's experience should be documented in writing and confirmed by the supervisor. An ongoing logbook should be kept for this purpose. For each performance or participation during the training period, the following facts should be documented in a log: date, identifying number of the patient, patient age, indication for the procedure, complications, and signature of the supervi-

**TABLE 2. Some Technical Skills Needed to Perform Cardioversion**


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1. Proper application of monitoring electrodes, to ensure a satisfactory monitor tracing
2. Technically correct recording of an ECG rhythm and of 12-lead tracings, before and after the procedure
3. Proper preparation of patient's skin before application of cardioversion electrodes
4. Proper preparation of cardioversion electrodes (with saline jelly) and application to the chest wall
5. Proper triggering of discharge
6. Advanced Cardiac Life Support skills, as evidenced by current certification
7. Proper application and operation of an external pacing device, should it be necessary

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sor. Experience in relating to patients in a compassionate manner should also be confirmed.

Although many physicians acquire the cognitive and technical skills needed for cardioversion during the training programs, completion of the program in and of itself does not guarantee competence in cardioversion. Some training programs do not specifically teach cardioversion. Although such programs may provide overall experience in cardiology that would contribute to competence in this procedure, lack of direct experience with cardioversion during the program precludes competence on its completion.

Completion of a course or workshop that offers a limited cognitive background in cardiology or that offers inadequate hands-on experience in the performance of cardioversion will not result in competence.

In light of these variations in training programs, applicants for clinical privileges should be evaluated on the basis of the actual skills they possess, rather than on the basis of the type of training program completed. The cognitive and technical skills of candidates should be attested to by the supervisor. When the competence of any physician requesting privileges is not clear, observing the candidate performing the procedure may be appropriate.

#### Maintenance of Competence

The Task Force recommends that a minimum of four procedures a year be required to maintain competence after initial certification.

In contrast to most special procedures in cardiology, cardioversion demands a minimum of technical skills but a maximum of cognitive skills. The latter refers to a thorough knowledge of indications, contraindications, complications (and their management), and adjunctive use of drug therapy. This includes knowledge of the current status of the use of warfarin, antiarrhythmic agents and modification of digoxin usage. This body of knowledge has changed in the 25 years since the procedure was introduced, and such changes may be expected to continue. Thus the requirement for participating in a

minimum of four cardioversions a year to maintain competence implies a review of current knowledge on these matters and appropriate modification of strategy.

Currently there are no data to document a correlation between the frequency of performing the procedure and practitioner skill or complication rate. Therefore, as part of quality assurance programs, a random sample of cardioversions performed by a physician requesting privileges should be reviewed periodically to confirm that indications and management were appropriate and complication rates acceptable. These records should be examined by a physician experienced with the procedure or one who is currently training physicians to perform cardioversion. If no one within the hospital is qualified to investigate a candidate's experience in this way, an outside qualified expert should be consulted.

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