Synchronized Cardioversion of Unstable Supraventricular Tachycardia Resulting in Ventricular Fibrillation

Lyndon C. Xavier, MD
Abdul Memon, MD

To the Editor:

Electrical cardioversion and defibrillation are applied on numerous occasions for the treatment of tachyarrhythmias. For cardioversion to be carried out safely, the rhythm is synchronized with the peak of the R wave, thus avoiding the delivery of electrical energy during the vulnerable period of repolarization, which can result in ventricular fibrillation. To avoid this error, it is recommended to look in additional leads when bizarre QRS-T complexes are present (Figures 1 and 2).

The importance of checking other leads before synchronized cardioversion is illustrated by the following case.1 A 76-year-old man with a medical history significant for ischemic cardiomyopathy underwent a right hemicolectomy for colon cancer. The patient was doing well until the third postoperative day, when he developed hemodynamically unstable supraventricular tachycardia with a ventricular rate of 150 beats/min. He underwent urgent synchronized cardioversion with 100 J; however, the shock induced ventricular fibrillation (Figure 2). The rhythm was quickly recognized, and immediate defibrillation with 360 J was effective (Figure 3). The patient was successfully resuscitated.

Guidelines for Letters to the Editor

Annals welcomes letters to the editor, including observations, opinions, corrections, very brief reports, and comments on published articles. Letters to the editor will not be accepted if they exceed 500 words and 5 references. They should be submitted using Annals’ Web-based peer review system, Editorial Manager™ (http://AnnEmergMed.editorialmanager.com). Annals no longer accepts submissions by mail.

Letters should not contain abbreviations. A manuscript submission agreement, signed by all authors, must be faxed to the Annals office at the time of submission. Financial associations or other possible conflicts of interest should always be disclosed. Letters discussing an Annals article must be received within 8 weeks of the article’s publication. Published letters will be edited and may be shortened. Unpublished letters will not be returned.

Authors of articles for which comments are received will be given the opportunity to reply. If those authors wish to respond, their reply will not be shared with the author of the letter before publication.

Neither Annals of Emergency Medicine nor the Publisher accepts responsibility for statements made by contributors or advertisers. Acceptance of an advertisement for placement in Annals in no way represents endorsement of a particular product or service by Annals of Emergency Medicine, the American College of Emergency Physicians, or the Publisher.
Electrical cardioversion is generally accepted as the treatment of choice for hemodynamically unstable tachyarrhythmias. Synchronized cardioversion is used for supraventricular tachycardia and ventricular tachycardia and for defibrillation for ventricular fibrillation. There is a rare but potentially lethal complication of ventricular fibrillation if cardioversion occurs during the vulnerable period of repolarization, that is, around the peak of the T wave on the ECG. A similar mechanism has been proposed for the development of commotio cordis (the syndrome of sudden death resulting from low-energy trauma to the precordium in young sports participants without preexisting heart disease) where Link et al elegantly demonstrated that ventricular fibrillation can be consistently induced from energy delivered during the vulnerable period of repolarization from 30 to 15 msec before the peak of the T wave on the ECG. A similar principle is applied in the electrophysiology laboratory to evaluate the efficacy of intracardiac defibrillators.

Standards for cardiac monitors are published by the American Association for the Advancement of Medical Instrumentation. For defibrillators, the two most important criteria are for safely detecting and distinguishing between QRS complexes and T waves. The minimum range for the detection of the QRS amplitude is 0.5 to 5 mV, with a QRS duration ranging between 70 and 120 msec in adults. The committee also made recommendations to manufacturers for the possibility of high-amplitude T waves being misinterpreted as R waves, which might result in adverse outcomes.

**Figure 1 (Xavier and Memon).**
Baseline ECG (sinus bradycardia with first-degree atrioventricular block and right bundle-branch block).

**Figure 2 (Xavier and Memon).**
Synchronized cardioversion (100 J) for hemodynamically unstable supraventricular tachycardia, resulting in ventricular fibrillation.
In our patient, the defibrillator was automatically programmed to lead II. During the initial synchronized cardioversion, the device was synchronized to the T wave and this resulted in ventricular fibrillation (Figure 3A). This demonstrates the importance of careful lead selection.

The current guidelines for advanced cardiac life support recommend checking additional leads on the device monitor when there is difficulty in identifying the morphology of the rhythm.5

In an emergency situation, the exact characteristic of the ECG tracing on the monitor screen of the defibrillator is commonly overlooked. If at all possible, a lead with a prominent R wave should always be selected.

Lyndon C. Xavier, MD
Abdul Memon, MD
Department of Cardiology
University of Arizona–Sarver Heart Center
Tucson, AZ
doi:10.1016/j.annemergmed.2004.03.036

SARS Decision Rule: Who’s a Suspect?

To the Editor:

We read the article by Wang et al1 in the January 2004 issue of Annals with interest. However, we have concerns regarding the inclusion criteria used in the study. The Methods state that the population included was those who met the World Health Organization (WHO) definition for suspected severe acute respiratory syndrome (SARS) cases. The WHO criteria for suspected cases at the time of your study included fever, coughing or breathing difficulty, and one of the following: close contact, travel, or residing in an area with recent transmission of SARS within 10 days before the onset of symptoms. We understand that Taiwan became an endemic area just around the time of your study, and thus may not yet have been factored into your inclusion criteria. However, in Table 1, 42% of the patients without SARS did not have a history of travel or exposure, and in Table 3, 73% of the SARS patients and 40% of the non-SARS patients had no history of exposure or travel. Assuming that the inclusion criteria are patients who meet the WHO criteria for suspected cases, how could some of the patients in the study have no history of exposure? We would appreciate your clarification of this seeming incongruity.

Jennifer H. Tan, MD
Department of Emergency Medicine
Highland Hospital
Oakland, CA
Ellen J. Weber, MD
Division of Emergency Medicine
University of California–San Francisco
San Francisco, CA
doi:10.1016/j.annemergmed.2004.01.038

In reply:

We appreciate the comments by Dr. Tan and Dr. Weber. When the community outbreak occurred in Taiwan, it was difficult for us to clarify whether the patients had had...