Cardiac arrest caused by undersensing of a temporary epicardial pacemaker

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The R-on-T phenomenon is a well-known entity that predisposes to dangerous arrhythmias. Typically, a premature ventricular complex occurring at the critical time during the T wave of the preceding beat precipitates ventricular tachycardia and fibrillation. This phenomenon can occur not only in asynchronous ventricular pacemakers, but also in synchronous pacemakers, if loss of sensing of the intrinsic rhythm becomes evident. A patient who was fitted with a temporary epicardial wire, following cardiac surgery and experienced repeated episodes of polymorphic ventricular tachycardia caused by the R-on-T phenomenon, is described.

Key Words: Cardiac pacing; Pacemakers; Ventricular tachycardia

The R-on-T phenomenon is a well-known entity that predisposes to dangerous arrhythmias. Although it is widely quoted in the literature, there are only a few illustrated cases reported. Some of these are related to undersensing of temporary pacing wires (1,2). Epicardial pacemaker wire insertion has been a standard practice after cardiothoracic surgery in most world centres. Despite the lack of systematic information, the rate of major complications associated with such wires is considered low. We report three polymorphic ventricular tachycardia episodes related to the R-on-T phenomenon caused by undersensing of the pacing wire in a single patient. Potential contributing factors associated with such complications, as well as preventive measures, are discussed.

CASE PRESENTATION

A 65-year-old man with hypertension, chronic obstructive pulmonary disease and peripheral vascular disease underwent coronary artery bypass surgery. Temporary epicardial pacing wires were left in place for backup pacing. During the early postoperative period, he developed significant sinus bradycardia requiring pacing support. His subsequent postoperative course was uneventful and after 24 h, he was transferred out of the intensive care unit with backup ventricular pacing at 50 beats/min in VVI mode.

In the postoperative unit, the patient had sudden cardiac arrest and was successfully resuscitated without cardioversion. He was intubated and transferred back to the intensive care unit. Telemetry recordings during the cardiac arrest revealed an episode of sustained polymorphic ventricular tachycardia caused by the R-on-T wave phenomenon (Figure 1A) triggered by asynchronous pacing from the temporary pacemaker. The corrected QT interval before the event was 440 ms. The patient's potassium and magnesium levels before the episode were 3.8 mmol/L and 0.6 mmol/L, respectively. The telemetry recording also revealed two other episodes of nonsustained ventricular tachycardia (Figures 1B and 1C) immediately before the cardiac arrest episode, also

Un arrêt cardiaque causé par la sous-détection d'un stimulateur épicaudique temporaire

Le phénomène R/T est une entité bien connue qui prédispose à de dangereuses arythmies. D'ordinaire, un complexe ventriculaire prématuré se produisant au moment critique pendant l'onde T du battement précédent précipite une tachycardie et une fibrillation ventriculaires. Ce phénomène peut se produire non seulement avec des stimulateurs cardiaques ventriculaires asynchrones, mais également avec des stimulateurs cardiaques synchrones si la perte de détection du rythme intrinsèque devient évidente. On présente le cas d'un patient à qui on avait installé un fil épicaudique temporaire après une chirurgie cardiaque et qui a présenté des épisodes répétés de tachycardie ventriculaire polymorphe causés par le phénomène R/T.

Figure 1) A Sustained polymorphic ventricular tachycardia related to R-on-T phenomenon. **B and C** Episodes of nonsustained ventricular tachycardia precipitated by pacing spikes delivered on the T wave

caused by asynchronous pacing stimuli on the T waves. On evaluation of the pacemaker, there was evidence of increased pacing threshold and intermittent loss of R wave sensing. The temporary pacemaker unit was turned off.

DISCUSSION

The R-on-T phenomenon leading to polymorphic ventricular tachycardia and cardiac arrest, occurring due to intermittent loss of sensing by the temporary pacing wire, has been reported previously (1,2). However, the present report is the first to show such a dangerous complication occurring consistently over a short period of

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time in the same patient. One of these episodes culminated in cardiac arrest.

Epicardial pacing wires usually fail to sense and capture after a few days. Increases in stimulation thresholds commonly occur after four days in both atrial and ventricular leads. Failure to pace is documented in more than 60% of wires placed in the right atrium and more than 80% of wires placed in the left atrium after five days (3,4). Furthermore, in acute postoperative periods, there is a potential proarrhythmic biochemical and metabolic milieu that can predispose to malignant ventricular arrhythmias. Despite the early postoperative period and absence of electrolyte abnormalities, our patient developed such a catastrophic complication.

The present case emphasizes the importance of checking a temporary pacemaker's pacing and sensing parameters on a daily basis after cardiothoracic surgery. Another important measure would be to avoid

backup pacing and to turn off temporary pacemaker generators when pacing support is no longer required.

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