

CASE REPORT

Nicorandil abolished repolarisation alternans in a patient with idiopathic long QT syndrome

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Abstract

A 23 year old woman with idiopathic long QT syndrome had repeated syncopal attacks associated with torsades de pointes. T wave alternans (TWA) was recorded and the QT interval was abnormally prolonged during treadmill exercise test. Monophasic action potential (MAP) alternans also appeared after an abrupt shortening of the cycle length in electrophysiological study. After intravenous administration of nicorandil 6 mg, both TWA and MAP alternans disappeared. (Heart 1999;82:e8)

Keywords: long QT syndrome; repolarisation alternans; nicorandil; potassium channels

T wave alternans (TWA) on an ECG is often linked to idiopathic long QT syndrome.^{1,2} A prolonged QT interval may reflect the presence of an electrophysiological substrate generating a polymorphic ventricular tachycardia known as torsades de pointes, and alternation of QT interval and T wave morphology has been implicated as a precursor of torsades de pointes. TWA is the consequence of alternation of the duration or shape, or both, of the ventricular action potential repolarisation. We report a patient in whom a potassium channel opener abolished alternation of monophasic action potential and TWA.

Case report

In August 1998, a 23 year old woman presented with repeated syncopal attacks. She had experienced the first syncopal attack, which normally occurred during sleep, in May 1987. ECG during syncopal attack revealed that TWA appeared immediately before extrasystoles, which were followed by torsades de pointes.

On admission, her heart rate was 86 beats/min and blood pressure was 100/60 mm Hg. There were no abnormal physical findings. Serum electrolytes and other blood chemistry tests were normal. The ECG revealed a noticeably prolonged QT interval of up to 520 ms and QTc of 620 ms (fig 1).

A modified treadmill exercise test (abrupt increment of loading; 0–13 Mets) was performed to induce repolarisation abnormality. TWA was seen most clearly in precordial leads

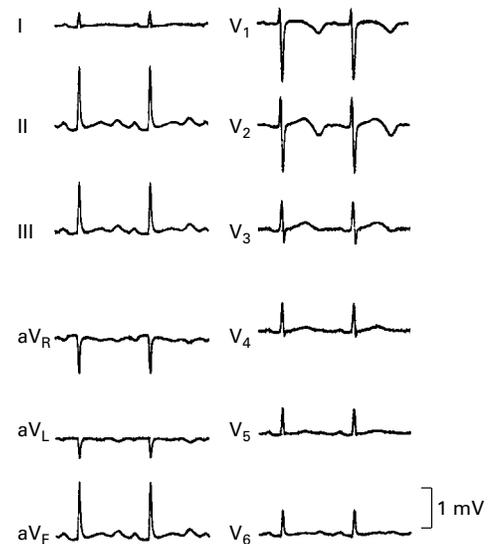


Figure 1 ECG on admission showing abnormally prolonged QT interval (520 ms) and QTc (640 ms).

(fig 2A). After intravenous administration of nicorandil 6 mg (blood concentration of 182 ng/ml), TWA disappeared (fig 2B).

Electrophysiological study was performed while the patient was taking no drugs. Monophasic action potential (MAP) was recorded from the inferoseptum of the left ventricle using the contact technique. MAP duration at 90% repolarisation (MAPD₉₀) was prolonged to 340 ms with phase three humps (right ventricular paced basic cycle length (BCL) of 545 ms). MAP alternans appeared after an abrupt shortening of the cycle length from 545 ms to 375 ms (fig 3A).

After intravenous administration of nicorandil 6 mg, sinus rate increased from 102 beats/min to 112 beats/min. MAPD₉₀ at a BCL was shortened to 305 ms, and phase three humps disappeared (paced BCL of 500 ms). MAP alternans was also abolished after an abrupt shortening of the cycle length from 500 ms to 353 ms (fig 3B).

Discussion

TWA has been shown to be an imminent precursor of life threatening ventricular arrhythmias. It is associated most frequently with an abrupt increment in the cycle length and prolongation of the QT interval. MAP alternans, a

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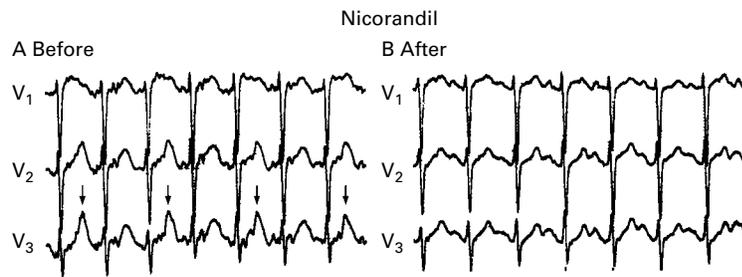


Figure 2 (A) Treadmill exercise test (abrupt increment of loading; 0–13 Mets) induced T wave alternans most clearly in precordial leads. (B) Nicorandil abolished T wave alternans.

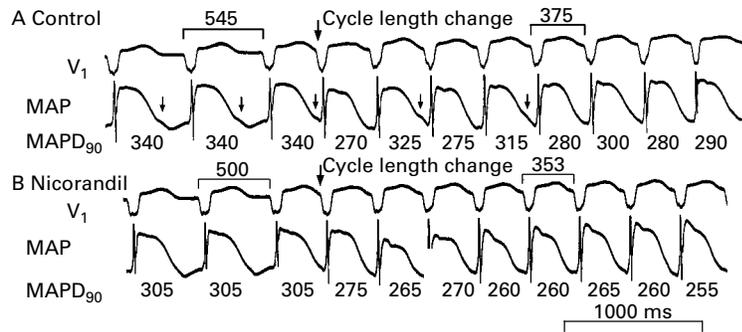


Figure 3 Simultaneous record of ECG and monophasic action potential (MAP). (A) Early afterdepolarisation (EAD) was recorded; MAP alternans appeared after an abrupt shortening of the cycle length. (B) Nicorandil abolished EAD and MAP alternans.

measure of regional repolarisation abnormality, may be responsible in part for the TWA on the surface ECG, which reflects global repolarisation abnormality.

In this patient, who had prolonged QT interval, $MAPD_{90}$ was prominently lengthened early afterdepolarisation (EAD) at inferoseptum of the left ventricle. TWA was induced by exercise, and MAP alternans was also observed after rapid pacing induced a sharp rise in the heart rate.

Nicorandil, which increases outward potassium current through K_{ATP} , can reduce the QT interval and action potential duration. Several reports have suggested that nicorandil suppresses EADs and abolishes ventricular arrhythmias with syncopal episodes in patients with idiopathic long QT syndrome.^{3–5}

Intravenous administration of nicorandil abolished repolarisation alternans in this patient, as well as EADs. To our knowledge, this is the first clinical demonstration of the effect of nicorandil on repolarisation alternans in a patient with idiopathic long QT syndrome.

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