A Family with Heritable Electrocardiographic QT-prolongation

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Summary. A report is presented concerning a family with heritable electrocardiographic QT-prolongation attacks of syncope and possible sudden death. In 23 family members investigated, nine living cases were found to have the anomaly. Of these nine patients at least two had had syncoops in early childhood. Hearing loss was found in three of the nine patients, but in one of them this could have been due to noise trauma and in another hearing loss was unilateral. The inheritance follows an autosomal dominant pattern. As far as we know this is the first report of this disease from The Netherlands.

In 1967, Ward reported a family in which some members suffered from a new disease that he called familial cardiac arrhythmia. He described two sibs with unexplained attacks of loss of consciousness. On investigation they had distinct electrocardiographic abnormalities. There was prolongation of the QT-interval and the aspect of the ST segment was very abnormal. Abnormal electrocardiograms were recorded in 10 of 28 family members. The inheritance followed an autosomal dominant pattern. We describe here another family with the disease.

Method of Investigation

After ascertainment of the propositus, his parents and three brothers were also investigated. The investigation consisted of physical examination, electrocardiogram, phonocardiogram, chest radiology, audiometric testing, and measurement of serum Ca, K, Mg, SGOT, LDH, CPK, and aldolase. Because the father and two brothers had the same ECG-abnormalities, the sibs of the father and their children were also examined. In these the programme was restricted to physical examination, ECG, and audiometric testing. The QT- and RR-intervals were read in lead II, the mean value of four consecutive complexes was taken. For calculation of the normal value of QT-time the regression formula of Fraser, Frogatt, and James (1964) was used:

\[ QT = a + b (RR) + c (R^2) + d \text{ (age)} \]

A prolongation of QT-time with more than 0.04 seconds was considered as abnormal.

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of her six children (III.9, III.10, and III.12), and
one brother (II.6) had a prolonged QT-interval.
The girl (III.9) is the only one who suffered from
syncopal attacks at the age of 3 years; she is now
without complaints at the age of 17 years.

No history of syncopees in childhood was obtained
from the father, his sister, or his brother. The
audiometric testing was normal in the families of
II.3, II.4, and II.6 and in II.5. The grandfather
(I.6) and his brother (I.5) died suddenly and un-
expectedly at the ages of 39 and 29 years. The
cause of death could not be ascertained.

The ECG data are summarized in Table I and
the family tree is shown in Fig. 1.

**TABLE I**

<table>
<thead>
<tr>
<th>Case</th>
<th>Age (yr)</th>
<th>Sex</th>
<th>RR (sec)</th>
<th>QT (sec)</th>
<th>QTc (sec)</th>
<th>Prolonged QT</th>
<th>Syncopal Attacks</th>
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</thead>
<tbody>
<tr>
<td>II.1</td>
<td>50</td>
<td>F</td>
<td>0.84</td>
<td>0.35</td>
<td>0.25</td>
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<td>0.91</td>
<td>0.36</td>
<td>0.25</td>
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<tr>
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<td>M</td>
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<td>M</td>
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<td>III.5</td>
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<td>F</td>
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<td>0.60</td>
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<tr>
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</table>

**Discussion**

In this family with heritable electrocardiographic
QT-prolongation nine of 23 members showed a
prolongation of the QT-interval. Probably only
two of these nine suffered from syncope at an early
age. They have now been without symptoms for 5
and 13 years, respectively, after the syncopal
attacks. The sudden unexpected deaths of the
paternal grandfather (I.6) and his brother (I.5) are
suggestive of the same disease. Only three of
the nine patients had a mild hearing loss of the per-
ception type. In one of these three this could have
been due to noise damage; in another the hearing
loss was limited to one ear.

The cause of the heart disease is not yet clear. In
contrast with the syndrome of Jervell and Lange-
Nielsen (1957) the atroventricular node artery is
normal. The myocardium and conducting tissue
have a normal histology (Ward, 1967). Probably
the disturbance of repolarization is caused by a bio-
chemical disorder at the cellular level (Fraser et al,
1964). The syncope attacks are caused by ventric-
ular fibrillation. Syncopes in infancy or childhood
followed by a symptom-free interval of many years
were found by various authors (Fraser et al, 1964;
Garza et al, 1970). Although the QT-interval is
shortened and the T-wave acquires a more normal
aspect with digitalis, syncope, and sudden death
have also been observed under digitalis therapy.
Our patients were not treated with digitalis.
The mode of inheritance in this family is clearly dominant. Both the mode of inheritance and the absence of bilateral deafness in most cases show that this disease is different from the syndrome of Jervell and Lange-Nielsen which is an autosomal recessive disease. Dominantly inherited cases of the syndrome without deafness have also been described by Barlow, Bosman, and Craig Cochrane (1964), Romano (1965), and Garza et al (1970). Ours is the first report from The Netherlands.

We gratefully acknowledge the help of Dr E. H. Huizing, Department of Otorhinolaryngology of the University Hospital Leiden, for the audiomeric testing of 19 members of the family.

REFERENCES


