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High Resolution Atrial Depolarization of MZ Twins Detected by Surface Signal Averaging Technique

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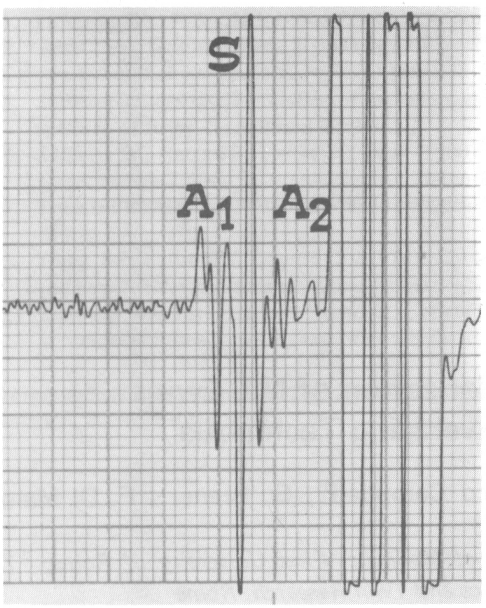
Abstract. High resolution tracings of atrial depolarization can be obtained by surface signal averaging technique. A study was conducted on 4 male and 4 female healthy MZ twin pairs aged 10.4 ± 1.3 yrs. Each subject underwent 3 or more recordings, at 10-days intervals. The essential reproducibility could be confirmed, with personal characteristics, as well as the reliability of the technique and the electrophysiological value of the spikes complex. In 3/8 pairs the cotwins showed a significant likeness of the atriogram, while in 5/8 pairs the tracings were not quite resembling between the twins and that is attributed to variations in the chronogenetic characteristics of MZ twins.

Key words: Electrocardiogram, Twins

Atriogram analysis is made possible by high resolution electrocardiography by surface signal averaging techniques [2,5,8]. The atriogram appears to be constituted by a double spike complex, the duration of which normally varies from 90 to 130 msec (Fig. 1), the spikes being related to the activation of the different segments of the two atria. The atriogram is fairly characteristic of the individual and we have found it to be constant in time, with only slight modifications related to the variable level of neurogenic atrial activation (Fig. 2) [1,3,4,7,9].

We have considered it likely, therefore, that the interindividual variability of the atriogram be at least partly determined by genetic factors and have consequently undertaken the present twin study [6]. In the following, we shall report on the results obtained in a first sample of 8 MZ (4 male, 4 female) twin pairs.

The computerized electrocardiography tracings are obtained on three channels: a standard electrocardiogram is recorded in the lower channel; this is then amplified 20 times in the middle channel, and 400 times in the upper channel (Fig. 3).



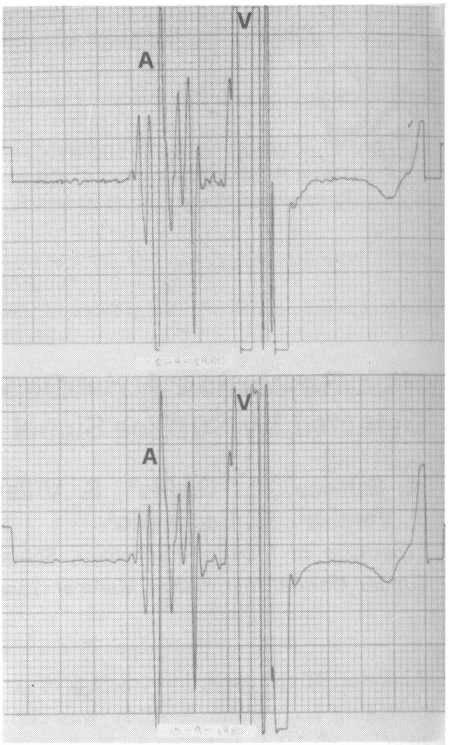


Fig. 1 - The normal atriogram's spike complex.

Fig. 2 - Atriograms of the same individual at different times.

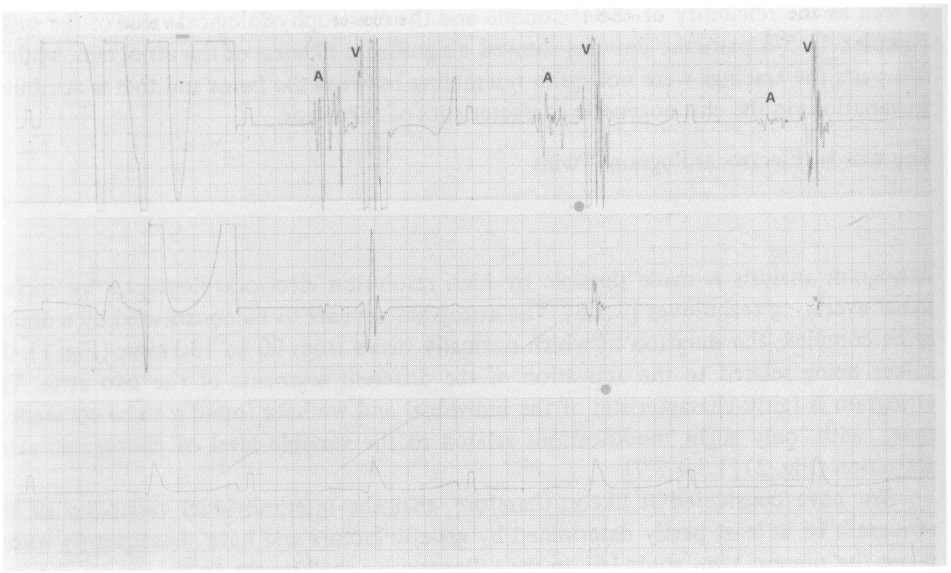


Fig. 3 - Computerized electrocardiography amplification: normal ECG (below) amplified 20 times (middle) and 400 times (above).
R.P., normal subject, aged 25. Atrial depolarization made by spike complexes (Averaging 512, lead aVL, amplitude 5 mm/mV).

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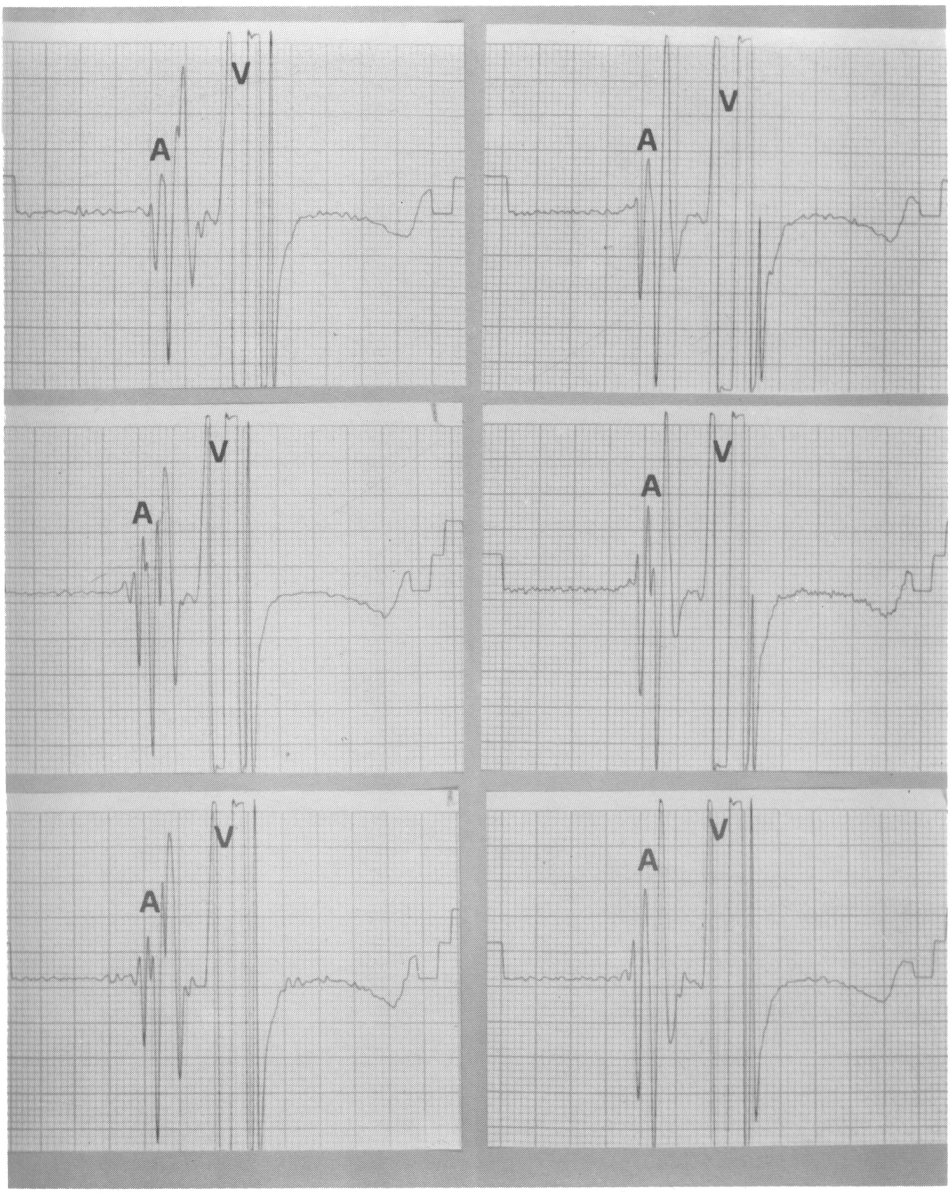

Fig. 4 - Almost identical atriograms in the cotwins (shown side by side) of three MZ twin pairs.

For the purpose of statistical analyses, the atriograms have been subdivided into three parts: A_1, the wave sequence preceding the spike; A_2, the wave sequence following the spike; and S, the positive or negative spike (Fig. 1). Duration and number of positive and negative peaks have been considered for A_1 and A_2, while duration and amplitude (in cm) of the positive peak and negative peak of the spike have been considered for S, thus obtaining 3 values for each of the 3 parts of the atriogram (A_1, A_2, A_3).

Student's t test for small samples has been used to compare these values in the cotwins of the 8 MZ pairs. The Table shows the t values obtained for each of the 9 para-

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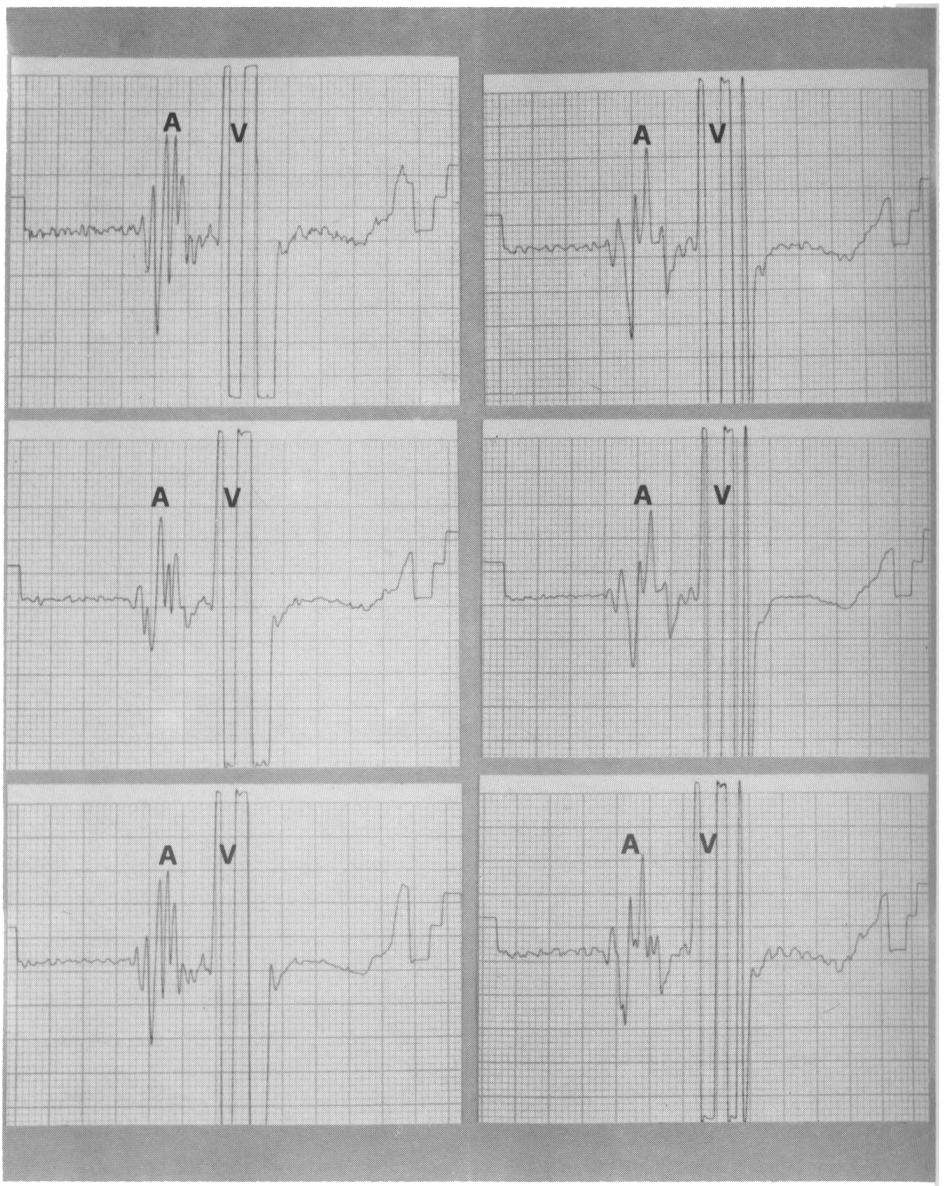

Fig. 5 - Similarities in the atriograms of the cotwins (shown side by side) of three MZ twin pairs.

meters. In addition, the final columns indicate the extent of the within-pair similarity: low (+), average (++), or high (+++). The analysis shows the atriograms of cotwins to be identical in 3 pairs, fairly similar in 2 more pairs, and highly different, though with respect to only one sector of the atriogram, in the remaining 3 pairs.

The finding of identical atriograms in the cotwins of 3 out of 8 pairs and their repeating morphology (Fig. 4) certainly stands in favor of a genetic background underlying the phenotypic expression of the electrical activity. On the other hand, the finding of

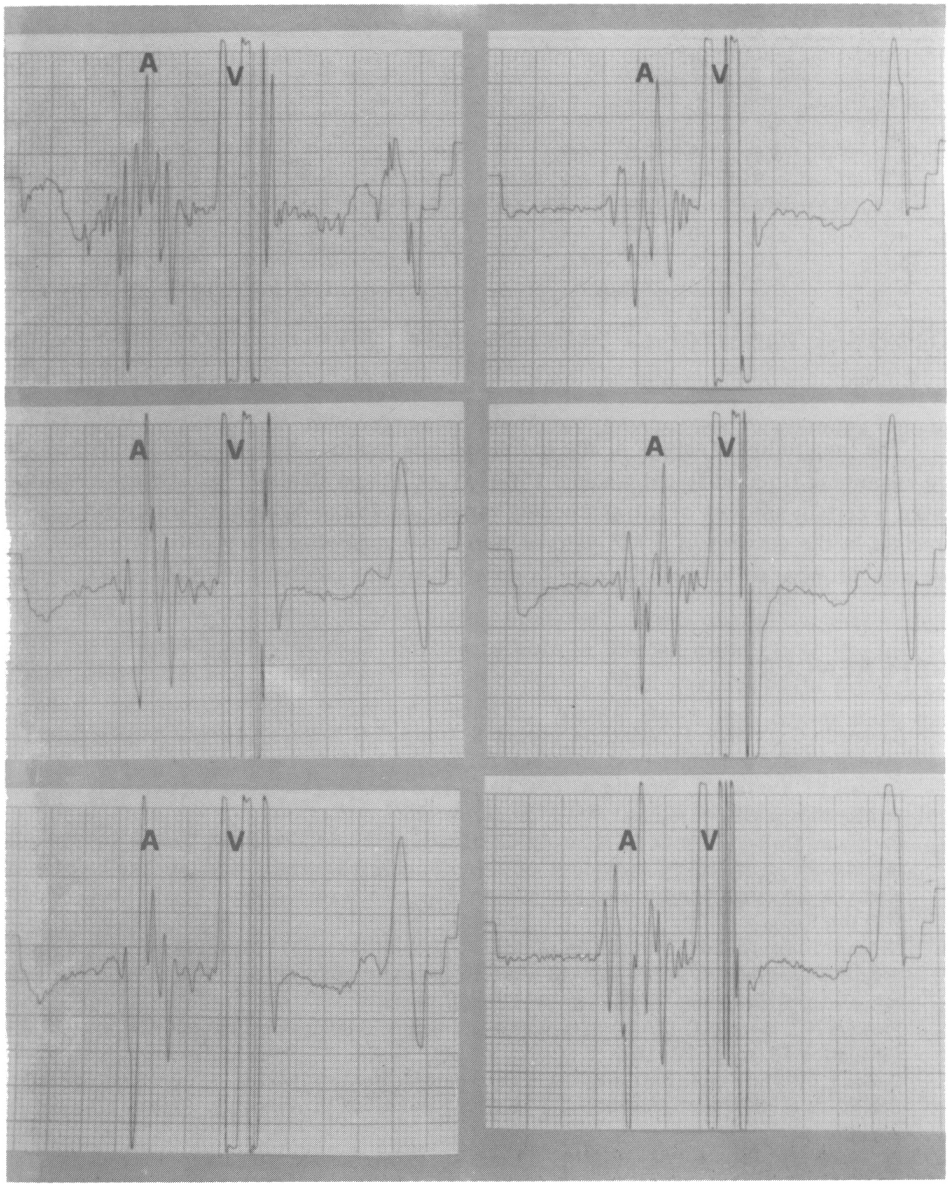

Fig. 6 - Differences in the atriograms of the cotwins (shown side by side) of three MZ twin pairs.

slight (Fig. 5) to relevant (Fig. 6) differences in the atriograms of the cotwins of the remaining 5 MZ pairs clearly indicates that environmental factors must also be at work.

Placentation could perhaps play a role, since monochorial twins, who represent about two-thirds of all MZ twins, are known to be at high risk of prenatal damage and death as a result of fairly frequent disturbances of their feto-placental circulation. The pairs with discordant atriograms might thus be monochorial pairs, but unfortunately we are unable to substantiate this hypothesis with the actual obstetrical data.

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Table - **Atriogram Comparisons in MZ Twin** (Student's t values)

	Al			S			A2			Similarity		
Pair no.	t	+	–	t	+	–	t	+	–	Al	S	A2
1	4.6	1.4	2.0	0	.8	1.8	.3	.9	1.1	+++	=	=
2	.9	.4	1.1	1.1	0	.4	1.3	.9	1.2	=	=	=
3	1.0	0	2.0	0	2.6	1.0	.5	2.6	1.0	=	+	+
4	0	0	.9	2.3	4.6	.5	1.2	.6	1.4	=	+++	=
5	2.2	1.2	2.6	1.2	1.6	1.0	1.6	2.0	0	+	=	=
6	1.3	1.0	1.3	.6	.6	.4	1.3	1.0	.9	=	=	=
7	1.0	0	1.3	0	1.5	2.5	.3	4.3	5.3	=	=	+++
8	1.2	.4	.9	1.1	1.4	.1	1.0	0	.3	=	=	=

The longitudinal analysis of the individual atriograms – that we have also conducted by examining three different tracings for each individual at 10 days distance – has indicated a certain amount of intraindividual variability. In this light, our finding of identical tracings in the cotwins of 3 MZ pairs is even more suggestive of a genetic influence, that we now propose to investigate more in depth through a comparison of MZ and DZ pairs.

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