CARDIAC ELECTROGENESIS IN TWINS

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Vectorcardiographic and electrocardiographic examinations were made in MZ and DZ twins, triplets and quadruplets. The similarity of the cardiac electrogenesis in the twins was studied using the correlation calculation after the affinic transformation of the vectorcardiograms and the multipolar description of cardioelectric field. The similarity of electrocardiograms and vectorcardiograms in MZ twins depends on heart electrogenesis.
The differences appearing during the neonatal period result from a nonuniform course of circulation organ adaptation and the establishment of conduction pathways in the newborn heart.

Our earlier studies (Jagielski and Nolisowa 1965, Jagielski et al. 1965) and literature data (Pedich 1962 and 1965*a*) dealing with electrocardiographic similarity in twins were based on the electrocardiographic and vectorcardiographic records that are largely influenced by the heart location and chest structure.

The present studies are also based on the material of electrocardiographic and vectorcardiographic records. The classic Duchosal's system of leads and the network leads were used (Kowarzyk et al. 1965). The automatic affinic transformation of vectorcardiograms was applied to distinguish changes of the heart orientation (Kowarzyk et al. 1971). The correlation index was used to compare the vectorcardiograms. Twins were examined both serologically and anthropometrically. The serological examination concerned the following systems: ABO, Rh, Kell-Cellano, P, ABO group substance secretion, Hp, and Gm. The anthropological examination included dermatoglyphic analysis (according to Wendt 1955 and to Orczykowska-Swiatkowska et al. 1972). Our procedure made it possible to differentiate with greater accuracy between MZ and DZ twins.
The material examined includes 17 DZ and 14 MZ twin pairs, one set of triplets, and one set of MZ quadruplets.

The similarity of MZ and DZ babies may be well illustrated in the case of the triplets. The set is DZ, two babies being MZ (A and C) and the third being different (baby B). The examination of these one-month-old babies and their parents gives the following correlation values: babies A-C, 0.97; babies A-B and babies B-C, 0.81; father-mother, 0.86. MZ twins (A and C) therefore show higher correlation values than DZ twins (A-B and B-C) and the values of the latter are close to those of their nonrelated parents. Very good correlations were found in the MZ quadruplets.
Table 1 presents the correlations of vectorcardiograms after affinic transformation respectively in MZ and DZ twins during the first days of life and after several months or years.
Surprisingly, the correlations in MZ twins are generally lower for the vectorcardiograms

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Table 1. *The Correlation of Vectorcardiograms of Twins after Affinic Transformation*

Twins	Sex	Age (days)	*r*	Age (years)	*r*
MZ twins					
A.B.-E.B.	F	1	0.90	6	0.98
B.S.-A.S.	M	1	.96	—	—
A.C.-C.C.	M	5	.96	1/12	.97
J.D.-A.D.	M	6	.99	5/12	.98
J.L.-B.L.	M	16	.88	2	.97
M.M.-E.M.	F	24	0.90	3	.97
K.J.-K.J.	F	—	—	15	.99
B.M.-L.M.	M	—	—	15	.98
K.S.-H.S.	F	—	—	15	.98
M.K.-E.K.	F	—	—	15	.97
M.J.-J.J.	M	—	—	16	.99
M.Z.-J.Z.	M	—	—	16	.99
B.P.-L.P	F	—	—	16	.98
Z.M.-K.M.	M	—	—	35	0.98
DZ twins					
A.B.-J.B.	FM	1	0.97	3	0.99
E.D.-M.D.	FM	1	.93	3	.83
D.K.-D.K.	FM	2	.98	2	.92
A.J.-K.J.	FF	3	.78	3	.95
M.G.-J.G.	FM	3	.68	2	.86
W.M.-W.M.	MF	3	.98	3	.94
W.H.-E.H.	MF	4	.56	2	.98
J.K.-Z.K.	MM	4	.83	3/12	.96
U.D.-B.D.	FF	5	.97	8/12	.98
H.S.-M.S.	FF	7	.77	3	.97
M.S.-Z.S.	MM	8	.91	2	.93
R.S.-E.S.	MF	8	.89	2	.90
K.K.-E.K.	MF	9	.96	5/12	.98
D.A.-J.A.	FF	18	0.94	3	.99
J.M.-J.M.	MM	—	—	2	.96
M.K.-W.K.	FM	—	—	4	.94
G.S.-J.S.	FM	—	—	8	0.71

derived in the first days of life than those derived later. This confirms that the course of heart adaptation to extrauterine life varies markedly even in MZ twins.

Table 2 shows the correlation indices of vectorcardiograms in cross-comparison between MZ twins in the newborn life. The twin newborns differ from each other because their adaptation to extrauterine life does not take a parallel course (James 1968, Jagielski 1970). This is expressed in Table 3 by the correlation indices in cross-comparison in the same MZ twins.

Evidence of similarity of MZ twin hearts is found in bioelectric examinations as well as in the multipolar description of cardioelectric field (Jagielski and Mozrymas 1971). The

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Table 2. *The Correlation of Vectorcardiograms in Cross-Comparison between the Female MZ Cotwins A.B. and B.B. after Affinic Transformation*

B.B. (days)	A.B. (days) 1/24	2	3	4	5	6	7	8	11
1/24	0.90								
2	.96	0.87							
3	.96	.96	0.98						
4	.90	.97	.97	0.85					
5	.95	.84	.93	.90	0.97				
6	.92	.87	.91	.87	.96	0.93			
7	.90	.98	.98	.88	.93	.94	0.88		
8	.92	.97	.97	.87	.93	.93	.89	0.94	
11	0.96	0.98	0.98	0.84	0.96	0.93	0.93	0.95	0.97

Table 3. *The Correlation of Vectorcardiograms in Cross-Comparison in the Female MZ Cotwins A.B. and B.B. after Affinic Transformation*

B.B. (days)	A.B. (days) 1/24	2	3	4	5	6	7
2	0.92 .98						
3	.98 .97	0.97 .98					
4	.98	.87	0.91				
5	.98 .95	.91 .96	.95 .97	0.97 .81			
6	.97 .91	.93 .95	.94 .95	.94 .83	0.96 .98		
7	.98 .92	.89 .92	.94 .97	.99 .98	.99 .94	0.95 .92	
8	.98 0.93	.91 0.91	.98 0.96	.99 0.99	.99 0.94	.94 0.93	0.98 0.99

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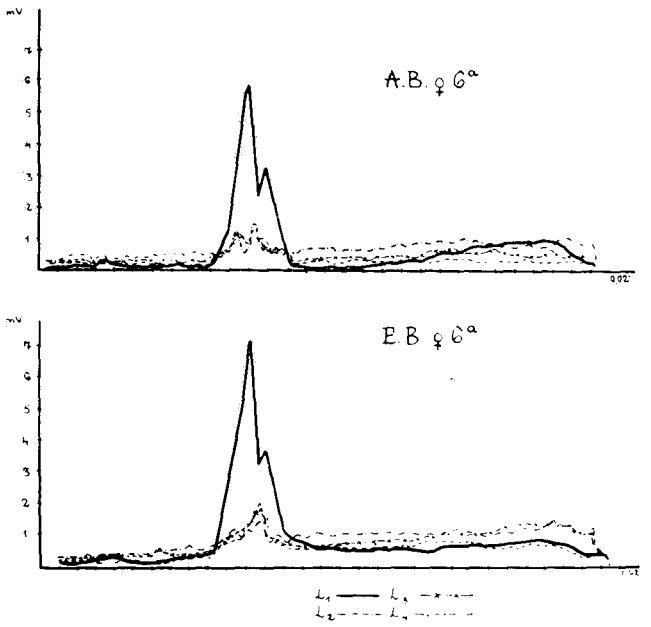

Fig. 1

result of multipolar analysis of the hearts of twins B.A.-E.B. is shown in the Figure, plotting ECG tracings obtained from potential measurements by means of numeric methods. These curves correspond to electric charge arrangements defined as dipole (L_1), quadrupole (L_2), octupole (L_3), and 16-pole (L_4). The multipolar description of cardioelectric field points to a very close similarity of MZ twin hearts, such similarity being also shown in the curves obtained for higher-rank multipoles, i.e., L_5, L_6, L_7, L_8.

It may be concluded that the similarity of electrocardiograms of MZ twins depends on heart electrogenesis and is independent from body structure and heart position. The differences found during the neonatal period result from a nonuniform course of circulation organ adaptation and establishment of conduction pathways in the newborn heart.

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