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Twinning and Blood Groups

I. ABO frequencies in twins and controls: immunological considerations

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Several studies have appeared in the literature to support the hypothesis of a differential incidence of twin births according to the antigenic structure of maternal erythrocytes (Gedda, 1961).

Osborne and DeGeorge (1957) wrote that twin births exhibit a higher incidence when mothers belong to group O, as compared to other groups within the ABO system; a similarly increased incidence of twin births was indicated for rh-negative mothers within the Rh-Hr system.

The availability of a large number of immunohematological data concerning twin pairs and nontwin individuals examined in our Institute have encouraged us to verify whether this material could reveal some *a posteriori* effect of the selective tendencies that have been related to the parental level.

Limiting our study in this phase to the ABO system, we have collected data on 1190 twin individuals and 1454 nontwin individuals, for all of whom the ABO blood group had been recorded.

The first step in our analysis was the perequation of the nontwin distribution to the twin distribution, obtaining the figures reported in the column " controls " in Tab. I.

A second step involved the comparison of our experimental frequencies to the expected frequency for a population such as the one from which our sample was drawn. In the absence of such a comparison, we would have normally adopted as expected distribution the intermediate distribution between twins and controls, thus adopting a double-tail test. Yet, a comparison between the distribution of our control sample and the corresponding values for the population of Rome and the surrounding regions (Mourant et al, 1958) revealed their substantial superimposability. Since both our experimental samples (twins and controls) belong to the same population, this finding enabled us to adopt the distribution of our control sample as expected distribution.

Applying to our distributions the statistical test of the χ^2 (Tab. I), we find in the first place that the difference is significant; we also note that the largest contribution to the total χ^2 value comes from the AB class, in which the low frequency of twins, as compared to the expected value, is especially significant.

Relating this finding to our introductory remarks, we must recall that group AB individuals are exactly those whose mother can never belong to group O. Thus,

we believe we can state that other authors' finding, according to which twin births are more frequent in the case of group O mothers, agree with our finding of a diminished frequency of group AB individuals in a twin population.

As far as the mechanism responsible for this phenomenon is concerned, we believe that it should be sought either in the endocrinological or the immunological field.

In the first case, an increased hormonal incretion would result in a higher incidence of polyovulation; while, in the second case, we could consider the possibility

Tab. I. ABO frequencies in twins and controls

	Twins	Controls	χ^2	P
O	518	540.2	0.9123	0.34
A	502	460.8	3.6836	0.05*
B	137	134.2	0.0581	0.80
AB	33	54.8	8.6722	0.003**
Total	1190	1190.0	13.3263	0.005**

of a protective action of the twin pregnancy against the effects of materno-fetal incompatibility. Other authors (Renkonen and Timonen, 1967; DeGeorge, 1969) preferred the first interpretation, relating it also to the finding of an increased frequency of twin births in women with a history of gynecological disease (ovarian cyst and myoma uteri).

Without excluding such an interpretation, we believe that the second hypothesis should also be considered. It seems fitting to note, in this respect, that the finding of an increased incidence of twinning in mothers belonging to group O and to type rh involves, in both cases, women who are homozygous for an " amorph "; i.e., those who have the highest probability of incurring phenomena of feto-maternal incompatibility.

The same conclusion may be reached if we take into account the fact that, if incompatibility were not involved, the excess of group O mothers ought to result in a corresponding excess of group O twin children. Yet, we see that, in our sample, the frequency of group O twins is slightly less than the expected value, while the frequency of group A twins (the class for which incompatibility phenomena are most frequent) shows a significant excess.

At this point, the problem seems to be whether the relationship between twinning and feto-maternal incompatibility is direct or indirect (primary or secondary).

A possible explanation of a direct relationship might involve an incompatible fetus, whose survival may be exceptionally favored if it shares the placental circulation with an antigenically different, compatible cotwin, whose metabolism would be undamaged.

In any case, both this primary relationship and the secondary relationship postulating a sort of " endocrinological rebound " would involve only DZ twin pairs.

We plan to explore the subject in further studies including MZ and DZ twin samples, differential parity, and the influence of paternal antigens, within the ABO, Rh-Hr, and possibly other blood group systems.

References

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