

The Absence of Close Linkage of Methemoglobinemia and Other Loci

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The absence of close linkage between hereditary methemoglobinemia due to enzyme deficiency and several blood group loci was previously reported (Scott *et al.*, 1963). We have now tested four other polymorphisms for possible linkage to methemoglobinemia and have added further evidence on the blood groups.

METHODS

The 49 families studied were of Eskimo or Athabaskan Indian origin, except for one Navaho family. Methods used were: diaphorase (Scott, 1960); red cell acid phosphatase, red cell phosphoglucomutase, haptoglobin, and Gc (Scott *et al.*, 1966); and albumin (Melartin and Blumberg, 1966). Blood was typed in the laboratory of Dr. Bruce Chown. *Lod* scores for complete pedigrees were calculated according to Morton (1955).

TABLE 1

LOD SCORES FOR LINKAGE BETWEEN METHEMOGLOBINEMIA AND POLYMORPHIC LOCI

Locus	No. of Families	No. of Children	LOD SCORE FOR RECOMBINATION FRACTION OF:				
			0.05	0.1	0.2	0.3	0.4
ABO.....	18	75	-10.2	- 5.8	-2.0	-0.7	0
MNS.....	31	154	-36.9	-21.0	-7.3	-1.9	-0.1
Rh.....	14	64	-10.0	- 4.9	-0.9	0.3	0.4
Duffy.....	6	28	- 4.3	- 2.2	0.2	0.3	0.3
Kidd.....	18	68	-17.7	-10.3	-3.9	-1.7	-0.6
P.....	6	31	- 0.7	0.1	0.5	0.4	0.2
Haptoglobin.....	12	46	-17.8	-11.4	-5.5	-2.6	-1.0
Rbc acid phosphatase.....	13	57	-13.9	- 7.7	-2.8	-0.7	0
Rbc phosphoglucomutase.....	6	23	- 1.4	- 0.3	0.4	0.4	0.1
Gc.....	8	30	- 6.9	- 3.9	-1.5	-0.5	-0.1
Albumin.....	4	14	- 4.6	-3.0	-1.4	-0.7	-0.2

RESULTS AND DISCUSSION

The results are shown in Table 1. Assuming a uniform distribution of the recombination fraction between 0 and 0.5, the probability of linkage of methemoglobinemia with any of these polymorphisms was .08 or less. It was not possible to test these fam-

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ilies for linkage with red cell adenylate kinase or red cell 6-phosphogluconate dehydrogenase, since variant forms of these have not been found in Alaskan Eskimos and Indians. On the other hand, we have confirmed the presence of a double albumin (Naskapi), which we have found in 14 of 137 unrelated Athabaskan Indians.

SUMMARY

Hereditary methemoglobinemia due to enzyme deficiency is probably not linked with blood groups ABO, MNS, Rh, Duffy, Kidd, and P, the red cell enzymes acid phosphatase and phosphoglucomutase, and the serum factors haptoglobin, Gc, and albumin.

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