Pericentric inversions inv(2)(p11q13) and inv(2)(p13q11) in 2 unrelated families¹

RUTH B. PHILLIPS

From the Department of Zoology, University of Wisconsin, Milwaukee, Wisconsin, USA

SUMMARY Pericentric inversions in chromosome 2 were traced in 2 unrelated North American black families. In the case of inv(2)(p13q11) no effect on reproduction was observed. In the case of inv(2)(p11q13) some reproductive abnormalities were noted which might be related to the inversion.

Although a reduction in fertility might be expected in inversion heterozygotes, evidence for this is limited (Moorhead, 1976). In the case of chromosome 2, 3 unrelated families with abnormal reproductive history were found to have inv(2)(p11q13) in a recent study (Leonard *et al.*, 1975). Since the frequency of this inversion in the normal population is not known, it is difficult to be certain of the effect of the inversion on reproduction. In the present study this inversion and a similar one were found in families with sickle cell trait who were karyotyped in connection with a family

study to determine linkage relation with the β -haemoglobin gene.

Materials and methods

The probands were karyotyped in a chromosome survey of relatives of sickle cell anaemia patients. Both of the probands had normal haemoglobin. The husband of proband 1 had sickle cell anaemia, and the husband of proband 2 had sickle cell trait.

Peripheral blood lymphocytes were cultured according to a modification of the method of Moorhead *et al.* (1960), with colcemid treatment of 2 to 4 hours. Air dried slides were prepared and stained with 0.5%

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Fig. 1 Diagram of normal chromosome 2 (left) and its inverted homologue (right) from 2 families. Lines indicate points of breakage.

Atebrin and mounted in 70% sucrose for fluorescence microscopy. Karyotypes were prepared according to the Paris Conference (1971).

Results and discussion

Chromosome analyses were carried out on cultured peripheral blood lymphocytes of 14 family members from 2 families. The results of the analyses are shown in Fig. 1, 2, and 3. Fig. 1 is a diagram of the 2 inversions showing the probable breakage points. Fig. 2 and 3 are partial karyotypes showing chromosome 2 in all of the individuals from the 2 families.

In Family 1 the mother had inversion $inv(2)(p11q13)$ and it was found in 2 of her 3 children (Fig. 2). The mother had 4 miscarriages, 3 known to be spontaneous. In Family 2, the mother had inversion $inv(2)(p13q11)$ and it was found in 2 of her 7 children (Fig. 3). There was no record of miscarriage or other reproductive abnormalities in this family.

The fact that reproductive abnormalities occurred in the family with $inv(2)(p11q13)$ is particularly interesting in view of the recent report (Leonard *et al.*, 1975) that 3 families with abnormal reproductive history were found to have this same inversion. The frequency of this inversion in the normal population appears to be low, with 1 case in 11 680 newborn infants found by Jacobs *et al.* (1974). The finding of reproductive abnormalities associated with this inversion in this study suggests evidence for a correlation

Fig. 3 Partial karyotypes of Family 2 showing chromosome 2. Arrows indicate inversion $inv(2)(p13q11)$ chromosomes.

between inversions and increased pregnancy wastage. No report of reproductive abnormalities with $inv(2)(p13q11)$ is available. A similar inversion in which the centromere was more terminally located was followed in 1 family for 3 generations (Weitkamp *et al.*, 1969). Most of the individuals appeared to be normal.

The inversions reported in this paper were found in 2 of 17 North American black families karyotyped in a linkage study. In this same group $inv(9)(p11q13)$ was found in 2 families and $inv(1)(p11q12)$ was found in another family. This high frequency of pericentric inversions supports an earlier report (Lubs and Ruddle, 1971) of a higher frequency of pericentric inversions in a newborn black population compared with a newborn white population.

References

- Jacobs, P. A. Melvin, M., Ratcliffe, S., Keay, A., and Syme, J. (1974). A cytogenetic survey of 11,680 newborn infants. *Annals of Human Genetics*, **37**, 359-368.

Fig. 2 Partial karyotypes of Family 1 showing chromosome 2. Arrows indicate inversion $inv(2)(p11q13)$ chromosomes.

- Leonard, C., Hazeal-Massieux, P., Boequet, L., Larget-Piet, L., and Boue, J. (1975). Inversion pericentrique inv(2)(p11q13) dans des familles non apparentées. *Humangenetik*, **28**, 121-128.
- Lubs, H. A., and Ruddle, F. H. (1971). Chromosome polymorphism in American negro and white populations. *Nature*, **233**, 134-136.
- Moorhead, P. S. (1976). A closer look at chromosomal inversions. *American Journal of Human Genetics*, **28**, 294-296.
- Moorhead, P. S., Nowell, P. C., Mellman, W. J., Battips, D. M., and Hungerford, D. A. (1960). Chromosome preparation of leukocytes cultured from human peripheral blood. *Experimental Cell Research*, **20**, 613-616.
- Paris Conference (1971). Standardization in human cytogenetics. *Birth Defects. Original Article Series*, **8**, No. 7, 1972. The National Foundation—March of Dimes, New York.
- Weitkamp, L. R., Janzen, M. K., Guttormsen, S. A., and Gershowitz, H. (1969). Inherited pericentric inversion of chromosome number two: a linkage study. *Annals of Human Genetics*, **33**, 53-57.
- Requests for reprints to Dr Ruth B. Phillips, Department of Zoology, University of Wisconsin, Milwaukee, Wisconsin 53201, USA.