Clinical Allergy, 1980, Volume 10, pages 309–312

P_1 incompatibility in pigeon breeders

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(Received 29 August 1979; accepted for publication 26 September 1979)

Summary

Pigeon breeders of the P_2 blood phenotype may develop anti-P_1 haemagglutinins as a consequence of natural immunization to pigeon dust. The half-life of labelled P_1 erythrocytes was determined in two P_2 pigeon breeders otherwise compatible except for the presence of anti-P_1 antibodies and in four compatible controls without anti-P_1. The half-life of tagged cells was within the normal range in one breeder but significantly reduced in the other, indicating that P_1 incompatibility may occur *in vivo*. Since anti-P_1 antibodies are found in about 20% of P_2 pigeon breeders, it is suggested that this group may be prone to developing an incompatibility to transfused P_1 red cells.

Introduction

We have reported that anti-P_1 haemagglutinins may occur in pigeon breeders of the P_2 blood phenotype as a consequence of natural immunization to pigeon dust (Radermecker *et al.*, 1975). These haemagglutinins are found in 18% of randomized P_2 pigeon breeders and more frequently in subjects who are selected on the basis of the presence of serum precipitins to avian antigens (Radermecker & Bruwier, 1977).

The purpose of the present study is to show that in pigeon breeders, these agglutinins may be responsible for reduced survival of transfused P_1 red cells. The possibility of a P_1 incompatibility should therefore be considered in P_2 pigeon breeders who are about to receive a transfusion of cross-matched and apparently compatible P_1 red cells.

Patients and methods

Red cells from a healthy P_1 blood donor were labelled with ^{51}chromium and injected into four compatible P_2 controls without anti-P_1 and into two otherwise compatible pigeon breeders except for anti-P_1 activity. The half-lives of the tagged erythrocytes in the two groups were compared. All the subjects were informed of the purpose of the study and gave their consent.

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0009-9090/80/0500-0309$02.00

Labelling of red cells and half-life determination

Forty-eight ml of venous blood were drawn from a healthy, Antigen Australia negative, ORH+P_1 blood donor into two plastic syringes each containing 6 ml of ACD medium (citric acid 0·8%, sodium citrate 2·2%, dextrose 2·24%). The red cells were isolated by centrifugation and labelled with ^{51}chromium (100 μCi of $Na_2\,^{51}CrO_4$) according to the technique recommended by the International Committee for Standardization of Techniques in Haematology (1971). The tagged red cells were washed three times with saline and resuspended in saline to a volume of 60 ml. Ten ml of the red cell suspension were injected intravenously into the four controls and into the two pigeon breeders (H.J. and P.H.) with anti-P_1 antibodies. Blood (4 ml in duplicate) was taken after 15, 30 and 60 min and every second day for 20 days. The radioactivity of the blood samples (C/min/ml) was measured in a gamma scintillation counter. The results are expressed as percentages of the radioactivity extrapolated at time zero.

Cross-matching tests; determination of the P phenotype and of anti-P_1 antibody

These determinations were carried out in the University Transfusion Service (Prof. A. André). P phenotype was determined by studying the ability of an anti-P_1 antiserum to agglutinate washed red cells at 10°C. Characterization of serum antibodies to P_1 blood group antigen was carried out by the panel technique, using test erythrocytes of known group and subgroup specificity. The haemagglutination reaction was conducted in a macromolecular medium at 10°C.

Results

Figure 1 shows the rate of disappearance of transfused labelled P_1 red cells estimated from the decrease of radioactivity as a percentage of initial value, in P_2 compatible controls and in P_2 pigeon breeders with anti-P_1 antibodies. The range of values observed in P_2 subjects without anti-P_1 activity is shown in the area between line (a) and line (b). The rate of disappearance of the tagged erythrocytes falls within normal limits in a pigeon breeder (H.J.) with anti-P_1 antibodies whereas it is significantly increased in the other (P.H.).

The half-lives of transfused P_1 red cells in the two groups under study are compared in Table 1. The range is 18, 2 and 20, 4 days in P_2 compatible controls with a mean of 19 days $\pm$ 1 s.d. The half-life of P_1 red cells is significantly reduced (12 days) in a pigeon breeder with anti-P_1 activity.

Discussion

In the absence of previous transfusion, a low level of anti-P_1 haemagglutinins is found in about 6% of blood donors of the P_2 phenotype (Radermecker *et al.*, 1975). Strong anti-P_1 activity on the other hand is known to be present in serum of patients with echinococciasis or ascariasis (Cameron & Staveley, 1957). This finding led to the demonstration of the P_1 blood group substance in the hydatid fluid and in the ectoderm of ascaris.

Roland & Effler (1973) found the P_1 antigen in gram-negative bacteria isolated from bird droppings and noted a high prevalence of anti-P_1 activity in the serum of bird fanciers immunized to avian antigens. Independently, we have shown a high incidence of anti-P_1 antibodies in pigeon breeders of the P_2 blood phenotype. This antibody belongs to the IgM class and is related to immunization to pigeon antigens as it frequently occurs in breeders (Radermecker *et al.*, 1975).

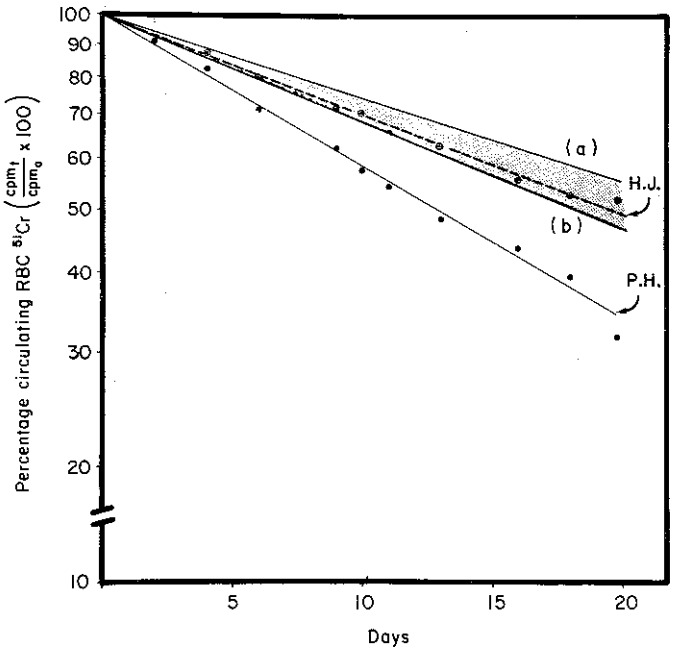

Fig. 1. Survival of tagged P_1 red cells transfused into four compatible P_2 controls and into two P_2 pigeon breeders (H.J. and P.H.) with anti-P_1 antibodies. The area between line (a) and line (b) represents the range of control values.

Table 1. Half-lives of ^{51}Cr labelled P_1 red blood cells injected into compatible P_2 controls and into P_2 pigeon breeders with anti-P_1 antibodies.

	Anti-P_1	Half-life of tagged RBC (days)
Controls		
GH	0	18·4
MY	0	19·5
BM	0	20·4
KN	0	18·2
Pigeon breeders		
HJ	++	19·3
PH	++	12·5

By immunoabsorption experiments, the P_1 substance or a related antigen was shown to be present in pigeon blood, serum and droppings (Brocteur *et al.*, 1975). Recently, François, Gerday & Beeley (1979) were able to show the presence of the P_1 substance in the egg white of pigeons or turtle-doves and identified it as a constituent of the ovomucoid molecule.

Since anti-P_1 antibodies are cold haemagglutinins, it is believed that P_1 incompatibility is not an important cause of transfusion reactions. However, Moureau (1945)

reported a fatality due to a post-transfusion haemolytic reaction which was attributed to anti-P_1 antibodies. More recently, Mollison & Cutbusch (1955) described the rapid destruction of about 50% of labelled P_1 red cells injected into a patient whose serum had a strong anti-P_1 activity. The present study confirms that P_1 incompatibility may occur *in vivo*. Pigeon breeders, who are particularly prone to acquire anti-P_1 antibodies by natural immunization to pigeon dust, should be considered at risk to develop a P_1 incompatibility. This possibility should be further investigated in countries where pigeon breeders are numerous.

Acknowledgments

We thank Professor A. André and Dr J. Brocteur of the Transfusion Department for the determination of the P phenotypes and of anti-P_1 antibodies.

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