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Immunological effect of co-trimoxazole on platelets

FRANS H J CLAAS, JOS W M VAN DER MEER, JANNEKE LANGERAK

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Summary and conclusions
Diminished survival of transfused platelets occurred in two patients given co-trimoxazole, and a third patient taking this drug developed thrombocytopenia. By means of an indirect immunofluorescence assay antibodies against donor platelets coated with co-trimoxazole were found in the sera in all cases. These antibodies were directed against the trimethoprim component of co-trimoxazole and not against sulphamethoxazole.

Co-trimoxazole is a potent antimicrobial agent and is advocated for treatment and prophylaxis in leukaemia. Hence its adverse effect on platelets is of great importance.

Introduction
Co-trimoxazole (trimethoprim-sulphamethoxazole), a potent antimicrobial drug, is effective in various infections. The antimicrobial activity is due to sequential blockade of the synthesis of folic acid: sulphamethoxazole competes with para-aminobenzoic acid in the synthesis of dihydrofolate, and trimethoprim inhibits dihydrofolate reductase, the enzyme that converts dihydrofolate to tetrahydrofolate.1 Reported haematological effects of co-trimoxazole 2 mostly concern megaloblastic transformation, which probably results from the effect of trimethoprim on dihydrofolate reductase. 3 It is not clear, however, whether thrombocytopenia or neutropenia or both in the absence of megaloblastic changes are also due to trimethoprim or caused by the sulphonamide component. 4 5

Two patients receiving platelet transfusions showed diminished survival of transfused platelets during treatment with co-trimoxazole, and a third patient taking the drug developed thrombocytopenia and neutropenia. We therefore used an indirect immunofluorescence assay to test sera from these three patients against donor platelets coated with trimethoprim, sulphamethoxazole, and the combined agent.

Subjects and methods
PATIENTS AND CONTROLS

Case 1—A 43-year-old man, suffering a blast crisis of chronic myelogenous leukaemia was treated with aggressive chemotherapy (daunorubicin, cytarabine, thioguanine, and cyclophosphamide) and total body irradiation, and given platelet transfusions because of thrombocytopenia. He then began a nine-day course of co-trimoxazole (2 tablets twice daily) for a bacterial infection. On day 3 of this treatment poor survival of transfused platelets was observed. When the course ended survival of transfused platelets became normal.

Case 2—A 20-year-old man received a bone marrow transplant for severe aplastic anaemia, and because of deep thrombocytopenia he was given platelet transfusions. The platelets survived poorly during two periods of six days in which he received co-trimoxazole (2 tablets twice daily) for a staphylococcal infection. After stopping the drug survival of the donor platelets became normal.

Case 3—A 52-year-old woman was being treated for staphylococcal spondylodiscitis. Because of penicillin allergy (fever and neutropenia) co-trimoxazole 3 tablets twice daily was instituted. On about the 10th day of treatment neutropenia (2 x 10^9 granulocytes/l (20 mm^3)) and thrombocytopenia (10 x 10^9 platelets/l (100 000 mm^3)) were found. After withdrawing co-trimoxazole there was a slow recovery.

Controls—Five hospital inpatients with normal platelet counts taking co-trimoxazole for various infections and 10 healthy blood donors served as controls.

METHODS
Platelet survival—Usually preparations from four different donors containing an average of 150 x 10^9 platelets were transfused. In the absence of immunological destruction this would be expected to increase the circulating platelet count by 20-30 x 10^9/l (20 000-30 000/mm^3) one hour after transfusion (in an adult of about 70 kg). Survival of transfused platelets was regarded as poor when the increase was less than 10 x 10^9/l.

Isolation of platelets—EDTA blood (1 part 5% sodium EDTA and 9 parts blood) was centrifuged for five minutes at 150 g. The upper layer of plasma containing the platelets was washed three times with phosphate-buffered saline containing 0.1% sodium EDTA, and a 1 x 10^9/ml suspension was made in this same medium.

Indirect immunofluorescence—Sera from the patients and controls were tested against platelets from healthy donors. Two drops of platelet suspension were incubated with two drops of test serum for 60 minutes at room temperature. After washing three times the platelets were incubated with two drops of TRITC-labelled goat-antihuman IgG(Fc) (Nordic Pharmaceuticals, Tilburg) for 30 minutes at room temperature. The platelets were then washed three times and the preparations examined by immunofluorescence microscopy.

Direct immunofluorescence—Platelets from case 2 were tested by direct immunofluorescence. Two drops of platelet suspension were incubated with two drops of TRITC-labelled goat-antihuman IgG(Fc) for 30 minutes at room temperature.

Incubation of platelets with antimicrobial agent—Platelets were incubated for 15 minutes at room temperature with 0.1 ml co-trimoxazole (16 mg trimethoprim and 80 mg sulphamethoxazole/ml, Wellcome-Nederland BV, Amsterdam), 0.1 ml trimethoprim (20 mg/ml, Wellcome-Nederland BV, Amsterdam), and 0.1 ml sulphamethoxazole (80 mg/ml, Hoffmann La Roche, Mijdrecht). After washing, the platelets were incubated with the test sera as described for the untreated platelets. The reactions of platelets incubated with each agent were compared with untreated platelets from the same donor.

Results
In the indirect immunofluorescence tests sera from all three patients were found to contain antibodies against platelets incubated with co-trimoxazole. These antibodies were directed against the trimethoprim component only (table).

During co-trimoxazole treatment in case 2 the patient's platelets were tested by direct and indirect immunofluorescence with his own serum; both tests were positive regardless of whether the platelets had been incubated with co-trimoxazole. Four weeks after stopping co-trimoxazole direct immunofluorescence on the platelets was negative with and without co-trimoxazole incubation. Nevertheless, when the platelets were incubated with co-trimoxazole the indirect immunofluorescence test became positive, indicating that the antibody was still present in his serum.
Drug-induced immune thrombocytopenia has been shown for several other drugs. The best known examples are quinine and quinidine,\textsuperscript{1, 2} but allylisopropylacarbamide\textsuperscript{3}; sulphaphenazole, diazepam, and phenytoin\textsuperscript{4}; and rifampicin\textsuperscript{5} have also been implicated. Why some patients develop these antibodies and others do not remains a subject for further study.

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