remission of haemolysis, with a negative direct antiglobulin test result; only weak serum autoantibodies were detectable. No autoantibodies were detected six weeks after the operation.

Comment

Warm autoimmune haemolytic anaemia is not uncommon in the course of lymphomas and other lymphoproliferative disorders[2] but is seldom seen in carcinomas. Ovarian tumours associated with immune haemolysis are well documented, and remission may be expected after removing the tumour, with the rapid disappearance of autoantibodies, some of which may have rhesus specificity.[3] The mechanism by which autoantibody production is stimulated is uncertain. The tumour may liberate substances that alter the red-cell surface, rendering it antigenic, or antibody may be produced by the tumour itself.[4] Alternatively, the tumour may stimulate production of an antibody that cross-reacts with erythrocytes. Immune haemolysis in other carcinomas is rare. Only two cases were listed in a classification of 187 patients seen over an eight-year period in Britain (carcinoma of breast and carcinoid of small bowel),[2] and two cases were reported in a five-year analysis in one of Sweden's health-care regions (bile-duct carcinoma and gastric carcinoma).[5] No serological information or response to treatment was given. In this case the rapid disappearance of antibody after removal of the tumour supports a cause-effect relationship, but the mechanism by which this occurred remains uncertain. Complete absorption of the autoantibody by the tumour is possibly in keeping with tumour material having stimulated the production of an antibody that cross-reacted with the host's erythrocytes.

We thank Dr D A Heath for permission to report on a patient under his care.

[1] Dacie, J V, *The Haemolytic Anaemias*, p 779. London, Churchill, 1967.
[2] Worllege, S, in *Blood and its Disorders*, ed R M Hardisty and D J Weatherall, p 726. Oxford, Blackwell, 1974.
[3] Bernstein, D, *et al*, *Obstetrics and Gynecology*, 1974, **43**, 276.
[4] De Bruyère, M, *et al*, *British Journal of Haematology*, 1971, **20**, 83.
[5] Böttinger, L E, and Westerholm, B, *Acta medica Scandinavica*, 1973, **193**, 223.

Departments of Medicine and Haematology, Queen Elizabeth Hospital, Birmingham B15 2TH

P A GORDON, MRCP, MRCPATH, senior registrar in haematology
P H BAYLIS, MB, MRCP, registrar in medicine

Regional Blood Transfusion Service, Birmingham B15 2SG

G W G BIRD, DSC, FRCPATH, director

Effect of virus infections on polymorph function in children

Many viruses have been shown to have an effect on the immune system in animals and in man.[1] Surprisingly little is known of the effects of virus infections on human polymorphs despite the occasional tendency for secondary bacterial infection to occur—for example, after measles and in the elderly with influenza.

As part of a wider study of immune mechanisms in children undergoing treatment for leukaemia and other malignancies, we have studied polymorph function at monthly intervals and at times of obvious infection and have correlated the results of these with infective episodes. Several children in the study have shown some depression of polymorph function during episodes of infection, and this study will be reported separately. These results, together with the finding by Larson and Blades[2] of an impaired response in normal human polymorphs treated with influenza virus in vitro, prompted us to look at normal subjects with viral infections.

Patients, methods, and results

Six children, aged 7 weeks to 18 months, with respiratory syncytial virus (RSV) infection and seven children, aged 5 months to 5 years, with influenza virus infection were studied. Diagnosis was by immunofluorescence,[3] and blood was taken during the acute phase of their illness. A stimulated nitroblue tetrazolium reduction test (NBT)[4] was performed on whole blood. Polymorphs were separated by centrifugation on Ficoll-Triosil gradients. Chemotaxis was measured in modified Boyden chambers using casein as the attractant, and killing ability was measured by incubating polymorphs with *Candida albicans*.[5] Individual experiments were controlled with polymorphs from laboratory staff and normal values derived from data obtained on 47 occasions from the staff. Nine babies, aged 1-28 days, admitted to a neonatal surgical unit with non-infective conditions and six other children, aged 4-14 years, were also studied. The means (± 1 SD) of the three tests are shown in the table.

Summary of results of polymorphonuclear leucocyte function tests. Results are means (± 1 SD), and numbers of individual tests are shown in parentheses

	NBT test (arbitrary units)	Chemotaxis (μm)	Killing ability (%)
Normal adults	12·3 : 5·1 (47)	75 : 6·5 (47)	22 : 7 (47)
Other children	13·4 : 4·8 (6)	78 : 4 (6)	24 : 6 (6)
Neonates	13·5 : 2·9 (8)	61 : 13 (7)	23 : 3 (5)
Children with RSV	7·0 : 3·8 (5)	46·9 : 21 (6)	12 : 5 (4)
Children with influenza	13·3 : 4·9 (7)	62 : 9·6 (7)	8·7 : 3·2 (7)

The NBT reduction test result was expressed in arbitrary units (100 · the formazan extinction value per 10^6 phagocytes). Chemotaxis was expressed as the distance in μm travelled by the leading front of polymorphs through the micropore filter. Polymorph killing ability was expressed as the percentage of the *Candida albicans* population that were killed. A standard *t* test was performed between the virus infected children and the normal adult controls. There was a significant difference between RSV-infected children and controls in the NBT reduction test result ($P<0.01$) and polymorph killing ability ($P<0.001$) and between the influenza-infected children and controls in polymorph killing ability ($P<0.001$).

Discussion

Polymorphonuclear leucocytes are an important part of the body defences against bacterial and fungal infection. The demonstration of defective function during episodes of viral infection would help to explain the occasional occurrence of secondary bacterial infection at these times, although there is no firm evidence that in the common viral infections in children, apart from measles, there is a significant incidence of such complications.

Larson and Blades[2] have recently reported defective ingestion of staphylococci by polymorphs treated in vitro with influenza virus. We have shown diminished candidacidal activity, which might also be due to a defect in ingestion. In addition, the normal NBT test result supports their findings of normal hexose monophosphate shunt activity in polymorphs treated with influenza virus. In the children with RSV infection both killing ability and NBT reduction were suppressed, which suggested a more general toxic effect on the polymorphs.

The advent of substances such as levamisole that may be able to improve the function of the immune system, including phagocytosis, makes the finding of depressed polymorph function in children whom we presume to have been previously normal of perhaps more than theoretical interest.

MMR is supported by the Tyneside Leukaemia Research Association. We thank Dr W Walker and Professor P S Gardner for their guidance.

[1] Notkins, A L, Mergenhagen, S E, and Howard, R J, *Annual Review of Microbiology*, 1970, **24**, 525.
[2] Larson, H E, and Blades, R, *Lancet*, 1976, **1**, 283.
[3] Gardner, P S, and McQuillan, J, *Rapid Virus Diagnosis*. London, Butterworth, 1974.
[4] Segal, A W, and Peters, T J, *Clinical Science and Molecular Medicine*, 1975, **49**, 591.
[5] Goldman, J M, and Th'ng, K H, *British Journal of Haematology*, 1974, **25**, 299.

Department of Child Health, Royal Victoria Infirmary, Newcastle upon Tyne

A W CRAFT, MRCP, senior registrar
M M REID, MB, research associate

Department of Haematology, Royal Victoria Infirmary, Newcastle upon Tyne

W T LOW, FIMLS, senior technician