changes then all those extra radiologists might not be needed.

C F LOUGHRAN
Clinical director

Macclesfield District General Hospital,
Macclesfield SK10 3BL

- 1 Ashworth TG. The future for histopathology: protectionism or prudence? *BMJ* 1994;309:417. (6 August.)
- 2 Royal College of Radiologists. *Medical staffing and workload in clinical radiology in the United Kingdom National Health Service*. London: RCR, 1993.
- 3 Chapman AH. Should radiographers perform barium enemas? *Clin Radiol* 1992;46:69.
- 4 Loughran CF. Reporting of fracture radiographs by radiographers: the impact of a training programme. *Br J Radiol* (in press).

Kleihauer testing

Need not be abandoned

EDITOR,—We recently conducted a survey of Kleihauer testing in the North Western region, and our findings are similar to those of Jennifer K M Duguid and Imelda Bromilow,¹ confirming the poor reproducibility and variability of the test as currently performed. We agree with Elizabeth A Letsky and Mahes de Silva that the reasons for the greater failure rate of prophylaxis with anti-D immunoglobulin in Britain compared with other countries require further investigation.² We do not automatically conclude, however, that the recommended standard dose of 500 IU for postpartum prophylaxis in Britain should be reviewed.

Our study entailed a comparison of Kleihauer testing in hospital with analysis by flow cytometry for the investigation of fetomaternal haemorrhage when the perceived volume was over 4 ml of fetal red cells. Flow cytometry measured Rh D positive cells rather than fetal haemoglobin, which the Kleihauer test measures.

Over 12 months we analysed 43 maternal samples, and in 18 cases the results of the Kleihauer test were in considerable excess of the results of flow cytometry. When a calibrated microscope was used for the Kleihauer test this excess occurred in only 12 cases. In 15 cases the dose of anti-D immunoglobulin required was calculated from the result of flow cytometry. So far none of the women followed up six months after delivery has been immunised. A simple calculation showed that use of flow cytometry saved 55 000 IU of anti-D immunoglobulin in these 15 cases alone. The potential for savings in cases of fetomaternal haemorrhage exceeding 4 ml is obviously greater.

For routine testing the Kleihauer test is simple and inexpensive and can be performed by any hospital laboratory. Its poor reproducibility and variability do not imply that it should be abandoned and a higher standard dose of anti-D immunoglobulin given but underline the need for comprehensive quality assurance and standardisation. We hope that this will be addressed by the introduction of the British national external quality assurance scheme for Kleihauer testing later this year.

We suggest that for the 99% of women who have a fetomaternal haemorrhage of less than 4 ml during delivery a standard dose of 500 IU of anti-D immunoglobulin together with properly performed Kleihauer testing is satisfactory. For the 1% of women who have a fetomaternal haemorrhage greater than 4 ml, standard practice could be supplemented by other methods, such as analysis by flow cytometry, in which the presence of Rh D positive cells rather than fetal haemoglobin can be examined.

E M LOVE
Deputy director
K H SHWE
Consultant haematologist

Manchester Blood Centre,
Manchester M13 9LL

- 1 Duguid JKM, Bromilow I. Value of Kleihauer testing after administration of anti-D immunoglobulin. *BMJ* 1994;309:240. (23 July.)
- 2 Letsky EA, de Silva M. Preventing Rh immunisation. *BMJ* 1994;309:213-4. (23 July.)

Quality assurance scheme exists

EDITOR,—Jennifer K M Duguid and Imelda Bromilow argue that the Kleihauer acid elution test for identifying fetomaternal haemorrhage should be replaced because of unreliability and inaccuracy.¹ We have evidence, however, that participation in a quality assurance scheme can improve performance and reproducibility.

The Scottish National Blood Transfusion Service has carried out a voluntary quality assurance scheme for Kleihauer testing in Scotland since 1988. Initially only the five regional transfusion centres participated, but more recently all 15 Scottish hospital transfusion laboratories that perform this test as part of the prevention of Rh D immunisation have taken part. Three exercises are set each year, each consisting of three coded blood samples (with known amounts of fetal red cells added); the participants receive identical samples for analysis. The laboratories are invited to treat the blood samples for slide preparation by the methods they usually use for testing clinical samples. To allow meaningful feedback, they are requested to read and express their results in a standard way (the method used by the quality assurance department of the scheme's organiser) based on the formula recommended by Mollison *et al.*² They are also requested to recommend the dose of anti-D immunoglobulin on the basis of their findings.

Returns are collated, coded, and returned to the participants in tabular form with the model answer so that each laboratory can identify only its own results but review the performance of its peers. Occasionally the scheme's organisers make a short pithy comment on the findings or share observations made by the participants, but otherwise the results are as presented. Fundamental technical problems such as inadequate staining, poor reading techniques, examination of insufficient microscopic fields, and use of inappropriate formulas soon came to light, and a confidential helpline was set up. Performance has considerably improved since the introduction of this scheme. False positive and false negative results are now uncommon, and the standard of reporting is high; we therefore have no plans to abandon the Kleihauer test. Efforts are now concentrated on the clinical interpretation and recommendations for anti-D immunoglobulin, with samples mimicking a larger fetomaternal haemorrhage being included.

We agree with Elizabeth A Letsky and Mahes de Silva that it is premature in Britain to abandon the simple and inexpensive Kleihauer test in favour of a larger routine postpartum dose of anti-D immunoglobulin of 1000-1500 IU on the ground of apparent economy³: this is by no means proved, and we are currently undertaking a cost effectiveness study in Scotland to examine this very point.

S J URBANIAK
Regional director
R MAIN
Quality assurance manager
N FRASER
Quality assurance officer

Aberdeen and North East Scotland Blood Transfusion Service
Regional Transfusion Centre,
Aberdeen Royal Infirmary,
Aberdeen AB9 2ZW

- 1 Duguid JKM, Bromilow I. Value of Kleihauer testing after administration of anti-D immunoglobulin. *BMJ* 1994;309:240. (23 July.)
- 2 Mollison PL, Engelkriet CP, Contreras M. *Blood transfusion in clinical medicine*. 8th ed. Oxford: Blackwell Scientific, 1988: 816-82.
- 3 Letsky EA, de Silva M. Preventing Rh immunisation: much scope for improvement. *BMJ* 1994;309:213-4. (23 July.)

Subjectivity leads to inaccuracy

EDITOR,—Elizabeth A Letsky and Mahes de Silva comment that maternal cells containing fetal haemoglobin do not contribute greatly to inaccurate interpretation of the Kleihauer test.¹ We agree with them, but, nevertheless, the Kleihauer test is relatively inaccurate because of its subjective nature. Inexperience with the technique and variable staining may sometimes lead to normal small lymphocytes mistakenly being counted as cells containing fetal haemoglobin.

Since our paper on Kleihauer testing was published² it has been drawn to our attention that, while a national quality assurance scheme for Kleihauer testing in the United Kingdom is being planned, a scheme has existed in Scotland for many years.

Since submitting our data for publication we have been comparing results of Kleihauer testing with results of flow cytometric estimation of RhD positive cells, using a single postnatal maternal sample for both tests; 425 samples have been tested. For 10 samples the result of the Kleihauer test indicated that additional anti-D immunoglobulin was needed; in only two of these cases would additional anti-D immunoglobulin have been given if the results of flow cytometry had been used. It therefore seems that, despite the apparent inaccuracies of the Kleihauer test, in the Mersey and North Wales region administration of anti-D immunoglobulin is more than optimal and the increased rate of RhD sensitisation remains unexplained.

JENNIFER K M DUGUID
Consultant haematologist
IMELDA M BROMILOW
Clinical scientist

National Blood Service Mersey and North Wales Centre,
Liverpool L7 8TW

- 1 Letsky EA, de Silva M. Preventing Rh Immunisation. *BMJ* 1994;309:213-4. (23 July.)
- 2 Duguid JKM, Bromilow IM. Value of Kleihauer testing after administration of anti-D immunoglobulin. *BMJ* 1994;309:240. (23 July.)

Immunofluorescence microsphere test developed

EDITOR,—We agree with Jennifer K M Duguid and Imelda Bromilow that a reliable test to measure fetomaternal haemorrhage is needed to replace the 35 year old Kleihauer test.¹ Our department has developed an immunofluorescence microsphere test for investigating erythrocyte chimerism after allogeneic bone marrow transplantation.² This test can detect very small subpopulations of red cells on the basis of antigenic differences, including RhD, between blood groups. The test has a sensitivity of 0.01%, which is far beyond that needed to establish fetomaternal macrohaemorrhage.

We applied our method in a group of 242 Rh negative mothers who delivered Rh positive children.³ After delivery fetomaternal haemorrhage occurred in 10 women and ranged from 0.44 ml to 24.28 ml fetal blood (mean 3.74 ml); fetomaternal macrohaemorrhages > 10 ml, which occur in 0.83% of all pregnancies,⁴ occurred in two of these women (11.56 ml and 24.28 ml). In the Netherlands 200 µg anti-D immunoglobulin is the standard dose after delivery, but this would have been too low for the woman with a fetomaternal haemorrhage of 24.28 ml. On the other hand, the standard dose used in several other countries (100-300 µg) is too high for most cases. This "overdose" of anti-D immunoglobulin is a waste of a scarce human blood product that has to be prepared from volunteer blood donors after stimulation with homologous red cells.

Our manual fluorescence microsphere test is based on visual counting in a counting chamber. Several other groups have used a fluorescence activated cell sorter to measure fetomaternal

haemorrhage.¹ The sensitivity was 0.1% at most, which is 10 times lower than the sensitivity of our manual technique. We have now developed a flow cytometric test, which has the same sensitivity (0.01% at about 1 in 10000 cells or 0.5 ml fetal blood) as our manual test (AJM de Man, personal communication). With this test it should be possible to screen large numbers of maternal blood samples for small fetomaternal haemorrhage. This could allow the adoption of a policy to reduce the usual dose of postpartum anti-D immunoglobulin below 100 µg because the dose needed can be calculated promptly once the results of the flow cytometric test are available. This policy could alleviate the shortage of anti-D immunoglobulin in Britain and the Netherlands. Use of a low dose of anti-D immunoglobulin post partum might result in enough immunoglobulin remaining for an antenatal programme to be established, as this has been proved to be effective.

BOB A VAN DIJK
Consultant in transfusion medicine

CHIEL J M DE MAN
Clinical scientist

VICTOR A J M KUNST
Professor of haematology

Blood Transfusion Department,
St Radboud University Hospital,
Nijmegen 6815 ET,
Netherlands

- 1 Duguid JKM, Bromilow I. Value of Kleihauer testing after administration of anti-D immunoglobulin. *BMJ* 1994;309:240. (23 July.)
- 2 De Man AJM, Foolen WJG, Van Dijk BA, Kunst VAJM, De Witte TM. A fluorescent microsphere method for the investigation of erythrocyte chimaerism after allogeneic bone marrow transplantation using antigenic differences. *Vox Sang* 1988;55:37-41.
- 3 Van Dijk BA, De Man AJM, Kunst VAJM. Quantitation of fetomaternal hemorrhage by a fluorescent microsphere method [abstract]. *Vox Sang* 1994;67 (suppl 2):0172.
- 4 Li TC, Bromham DR, Balmer BM. Fetomaternal macrotransfusion in the Yorkshire region. 1: Prevalence and obstetric factors. *Br J Obstet Gynaecol* 1988;95:1144-51.
- 5 Bayliss KM, Kueck BD, Johnson ST, Fueger JT, McFadden PW, Mikulski D, et al. Detecting fetomaternal hemorrhage: a comparison of five methods. *Transfusion* 1991;31:303-7.

Many cases of sensitisation may be avoidable

EDITOR,—Elizabeth A Letsky and Mahes de Silva advocate the introduction of routine antenatal prophylaxis to prevent Rh immunisation in pregnant women who are Rh negative and careful identification of women requiring postnatal prophylaxis.¹ Though their recommendations may be correct, some of their assertions are unfounded.

In an unreferenced statement the authors state that the main cause of Britain's continuing relatively high rate of sensitisation is failure to identify RhD negative women at risk and to give the standard postnatal dose within 72 hours of delivery. In a recent study of the causes and clinical consequences of RhD haemolytic disease of the newborn in Scotland, failure to give postnatal anti-D immunoglobulin was the identifiable cause of sensitisation in only four of 70 cases between 1985 and 1990.² In contrast, failure of the current guidelines, which had been properly implemented, to protect women from sensitisation was the identifiable cause in 53 cases: 19 cases were definitely attributed to antenatal immunisation in the first pregnancy, and 28 cases could have been due either to antenatal sensitisation in the second or subsequent pregnancy or to failure of prophylaxis properly administered in an earlier pregnancy. These results could be interpreted as indicating that, at least in Scotland, a programme of antenatal prophylaxis would have a major impact on sensitisation of Rh negative women.

However, in a prospective audit of implementation of a programme to prevent Rh incompatibility, which looked at 671 Rh positive babies born in 1120 consecutive pregnancies to Rh negative women, we identified 280 events recorded during

pregnancy that should have resulted in administration of anti-D immunoglobulin, according to current guidelines: the immunoglobulin was given in only 177 of these, usually because the event was not reported to the medical practitioner.³ This observation suggests that many cases of antenatal sensitisation may be ascribed to identifiable immunising events and could in theory at least be prevented by increased reporting of such events by the women themselves. A prospective trial is in progress in the Edinburgh region to establish whether involving pregnant Rh negative women in their antenatal care increases the incidence of reporting of potentially sensitising events.

WILLIAM G MURPHY
Senior lecturer

South East Scotland Blood Transfusion Service,
Edinburgh EH1 2QN

SUSANTA GHOSH
Consultant

East of Scotland Blood Transfusion Service,
Ninewells Hospital,
Dundee DD1 9SY

R H HUGHES
Senior registrar

Department of Obstetrics and Gynaecology,
Simpsons Memorial Maternity Pavilion,
Edinburgh EH3 9HB

J I O CRAIG
Associate specialist

South East Scotland Blood Transfusion Service,
Royal Infirmary,
Edinburgh EH3 9YW

I A GREER
Professor of obstetrics and gynaecology

Glasgow Royal Maternity Hospital,
Glasgow G4 0NA

- 1 Letsky EA, de Silva M. Preventing Rh immunisation. *BMJ* 1994;309:213-4. (23 July.)
- 2 Hughes RG, Craig JIO, Murphy WG, Greer IA. Causes and clinical consequences of rhesus (D) haemolytic disease of the newborn: a study of a Scottish population, 1985-1990. *Br J Obstet Gynaecol* 1994;101:297-300.
- 3 Ghosh S, Murphy WG. Implementation of the rhesus prevention programme: a prospective study. *Scott med J* (in press).

Water birth and infection in babies

EDITOR,—I wish to challenge J Rawal and colleagues' suggestion that a baby developed pseudomonas sepsis during a water birth.¹ The organism was not recovered from the blood, cerebrospinal fluid, or urine of the baby, and its presence on the ear and umbilicus is poor evidence that it was the agent of the presumed sepsis. Coliforms and *Pseudomonas aeruginosa* can be found on surface sites of babies without sepsis. Secondly, faecal spillage from the mother into the birthing pool often occurs, and *P aeruginosa* can be found in the gut of healthy people. The mother was the likely source of the organism cultured both from the swabs taken from the baby and from the specimens taken from the birthing tub and its accessories.

PHILIP SANDERSON
Consultant microbiologist

Edgware General Hospital,
Edgware,
Middlesex HA8 0AD

- 1 Rawal J, Shah A, Stirik F, Mehtar S. Water birth and infection in babies. *BMJ* 1994;309:511. (20-27 August.)

"Tax" on infertility is increased

EDITOR,—Further evidence of the government's penny pinching in the provision of health care was shown recently. The Human Fertilisation and Embryology Authority announced to the fertility clinics that it licenses that the fees levied for cycles of in vitro fertilisation are to be increased from £30 to £40 and those levied for donor insemination are to be increased from £7 to £10.

When this "tax" was first raised in 1991 I stated that it was "unfair, unacceptable, and unprecedented in medicine."¹ During the past three years the government's attitude to the treatment of infertile couples has changed little. Ninety five per cent of couples requiring advanced fertility care still pay for their treatment. Many fertility problems are caused by medical conditions—for example, the sequelae of endometriosis, pelvic infection, and oligospermia—or even have an iatrogenic cause. A government that professes to provide health care to all, equally, "from the cradle to the grave" is manifestly failing to do so. In the case of infertile people, however, not only does the government not provide the treatment but it further penalises them by charging a fee every time they attend for (usually private) treatment. It has increased this fee or tax by a third in the past three years; this is surely against its professed tenet of controlling inflation. The Human Fertilisation and Embryology Authority has no control over the decision to raise this fee: it has been required to collect 60% of its expenditure from licence fees, and this figure will be increased to 70% next year.

Britain is the only country in Europe in which the government does not provide some help with advanced fertility treatment. The government should remove its tax on infertility and address the problem of providing fertility treatment to all deserving couples equally throughout Britain rather than continuing to condone the haphazard system that now exists.

PETER R BRINDSEN
Medical director

Bourn Hall Clinic,
Bourn,
Cambridge CB3 7TR

- 1 Brinsden P. A tax on infertility? *BMJ* 1991;303:309.

Managing casualties of war

EDITOR,—We cannot agree with Robin M Coupland's suggestion that military medical forces and their medical planners, working for the United Nations under a humanitarian mandate, should abandon their traditional military approach to managing the casualties of war for an epidemiological one. Two dissimilar situations are being equated to obtain a single doctrine. This will not work.

The driving force for the military is to evacuate casualties from the front line as quickly as possible, administering sufficient care at each stage to allow this to happen; this applies to military and civilian casualties alike. The commander, politicians, the public, and, not least, the patients, however, expect that patients will receive the treatment that they would receive in peacetime in a developed society, although they make allowance for the special circumstances of the battlefield. In addition, patients may be picked up soon after wounding—a situation different from that usually encountered by Red Cross staff.

The military therefore always plan for full medical support based on a comprehensive infrastructure, including support from engineers, good communications, the provision of both pure water and an adequate diet, the availability of medical supplies, and the means of evacuation.

Civilian staff, on the other hand, may find themselves without this infrastructure and have to develop different concepts of triage. Short cuts are taken and ideals for treatment tempered by the situation. Lessons that undermine traditional teaching on the management of war should not be derived from the survival and recovery of the patients of civilian staff unless all pertinent factors have been considered. Like has to be compared with like and differences appreciated.

We suggest there are two important lessons to be learnt in such circumstances. Firstly, medical