rather than simply as "highly paid producers of services to be managed like a collective bargaining unit" (as Henry J Kaiser first considered the doctors he hired to provide medical care for his California shipyard workers during the second world war[11]). The Kaiser Health Plan currently offers several million members medical care on a prepaid basis and resembles the NHS in many ways. How a balance of authority and responsibility between doctors and management was fought for and achieved may be of special interest during current efforts to reconcile conflicting interests in the NHS.[11]

Intentions have been expressed and first steps taken. The government states that doctors should participate in management decisions, and doctors' incorporation as participants in clinical directorates has been debated extensively.[12] What remains to be completed is a clear formalisation of lines of authority and responsibility which recognise doctors as equal partners in a collaboration based on respect and trust in pursuit of a mutually agreed objective.[7] Only then will it be possible to achieve the full benefits that such a partnership can offer to the British public.

JOHN P BUNKER
Visiting professor

King's College School of Medicine and Dentistry,
Rayne Institute, London SE5 9NU

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Preventing incompatible transfusions

Most errors are human

Each year in Britain 2·2 million units of red cells are transfused and perhaps four deaths due to preventable causes subsequently occur. Providers of health care and the public express most concern about the risk of infections transmitted by transfusion, particularly HIV infection, but procedural errors resulting in ABO incompatibility cause most of the deaths immediately after blood transfusion.[1 2] ABO antibodies are "naturally occurring" and are present in all subjects except those of blood group AB after the first 3 to 6 months of life. Although these antibodies can cause intravascular haemolysis, with disseminated intravascular coagulation and renal failure, most incompatible transfusions are uneventful or result in minor signs and symptoms.[3 4] Only about 1 in 10 ABO incompatible transfusions is fatal.[2]

Studies in the United States, where all deaths associated with transfusions must be reported to the Food and Drug Administration, show that patients with blood group O are most at risk of dying from ABO incompatibility[1 2] because they have the highest concentrations of potent antibodies directed against A and B antigens. Other causes of death from transfusions, excluding viral infections, are generally not preventable. They include, in order of frequency of reports, acute lung injury related to transfusion, bacterial contamination of red cells or platelet concentrates, delayed haemolytic transfusion reaction due to non-ABO antibodies, transfusion of inadvertently damaged cellular components, and, very rarely, graft versus host disease.

Most incompatible transfusions result not from laboratory errors but from mistakes in identification such as the faulty labelling of samples taken for testing before transfusion or misidentification of the patient receiving the transfusion. Most transfusion errors result from blood being given to the wrong patient.[2 5 6] In a study in Glasgow of 20 000 recipients of more than 60 000 units of blood, an estimated 1 in 3 300 patients received ABO incompatible blood—all because of the failure to identify patients or blood samples correctly.[5] In fact, the true frequency with which the wrong blood was transfused must have been at least three times higher as the distribution of ABO blood groups in these patients is such that when the wrong blood is given by chance it is ABO incompatible in only one in three instances. This means that two out of three patients were fortunate enough to receive blood of their own or of a compatible ABO group even though they were not the intended recipient. Moreover, only those patients who had a reaction were investigated, which accounts for only a small proportion of those receiving incompatible transfusions. Recent studies show that the incidence of transfusion errors has not decreased.[6]

Data from the Food and Drug Administration suggest that during 1976-8, 39 deaths were primarily attributable to transfusions. Incompatible transfusions were responsible for the deaths of 24 patients, and all but two of these deaths were due to ABO incompatibility. The commonest cause of ABO incompatible transfusion was failure to identify the recipient correctly, and this mistake occurred most commonly in the operating theatre.[7] In a recent study in two London teaching hospitals of 400 units of red cells transfused into 200 patients, 56 of the patients were given at least one unit of blood without adequate documentation. Two thirds of these transfusions were given in the operating theatre (C Costello, personal communication).

Many systems have been described for minimising risks of misidentification.[8] Guidelines on documentation and procedures, prepared by the Blood Transfusion Task Force, were published in 1991[9] but have been largely ignored. Most hospitals still do not fully document transfusions.

McClelland and Phillips in this week's journal calculate a minimum estimate of the current rate of errors in the administration of blood in Britain (p 1205).[10] The authors identified 111 incidents over two years, which resulted in the death of six patients and morbidity in 12. These outcomes represent at least one death per 550 000 units transfused and one incident in which the wrong blood was given to the patient per 29 000 units of red cells transfused. Worryingly, only 40% of the laboratories that took part in the study indicated that they had a system for documenting these incidents, and over half the respondents provided information from memory.

Although in all hospitals haematologists are in charge of blood transfusion departments, most transfusion errors occur at the patient's bedside and are beyond the haematologists'

direct responsibility. Most transfusions are administered and documented by junior doctors, anaesthetists, and nurses—mainly a rotating group of staff—with hardly any proper training or awareness of local and national guidelines on operating procedures. It makes sense, therefore, to place overall responsibility for transfusions in hospital under single management. Most serious transfusion errors arise from breaches of current established codes of practice resulting in blood being given to the wrong patient.[1-3] Human errors are inevitable, but systems should be in place to minimise their occurrence. Improvement is possible. During 1986-93, 268 000 units of blood were transfused at the Mayo Clinic, and on only one occasion was ABO incompatible blood transfused owing to misidentification.[11] At the clinic only dedicated staff, including nurse transfusionists, are responsible for giving and monitoring blood transfusions.

All hospitals need to set up standard procedures for accurately identifying patients and recognising the signs of transfusion reactions. These procedures must be simple enough to be followed by staff in emergencies. Multidisciplinary audits of the quality of blood administration are invaluable to ensure compliance[8] and should be carried out regularly.

Finally, as McClelland and Phillips recommend, a central reporting system for collating data on all serious incidents related to transfusion, similar to that which exists for reporting adverse reactions to drugs, is needed. Until now the main concern has been to improve the quality and microbiological safety of the blood supply to hospitals by the blood transfusion service. It is time for the same resources and attention to be given at hospital level to ensure that blood is prescribed appropriately and administered safely to the intended recipient by well trained staff.

MARCELA CONTRERAS
Medical director
MAHES DE SILVA
Consultant haematologist
North London Blood Transfusion Centre,
London NW9 5BG

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Safety and magnetic resonance imaging

Avoid imaging patients with metal objects in their body

Magnetic resonance imaging entails a strong static magnetic field and changing magnetic and radiofrequency fields. Problems arise from any metal objects present in the body.

With magnetic resonance imaging, the whole body is in the magnetic field, and sensitive organs cannot be "screened"—as they can in most techniques that use ionising radiation. For example, a foreign object in the head can interfere with the magnetic resonance imaging of any part of the body, down to the toes, and the referring doctor and radiologist must be aware of any potential source of interference even if it is physically distant from (and unrelated to) the problem being investigated. Cleaners, engineers, and anyone accompanying the patient during imaging are subject to the same risks: nobody known to harbour or suspected of harbouring any hazardous object should come near the imager. The National Radiological Protection Board's arbitrary recommendation in 1983 that magnetic resonance imaging should not be performed during the first trimester of pregnancy has not been revoked.[1]

A cardiac pacemaker, the best known contraindication to entry to a magnetic resonance imaging suite, may be moved in the tissues by the electromagnetic fields or be irreversibly switched from demand to fixed rate operation.[2] The intracardiac wires of even a non-functioning pacemaker could cause arrhythmias. Some devices with magnetically or electronically operated switches, such as cochlear implants,[3] neurostimulators, implanted infusion pumps, and ventricular shunt valves whose opening pressure can be changed transcutaneously, are also contraindications to magnetic resonance imaging. Detachable objects such as magnetic stoma plugs and dental implants should be removed before imaging. Ocular prostheses may, however, have permanently implanted magnets, which, like those used with some radiotherapeutic implants, may be moved or demagnetised.[1]

Static hardware, including most of that used for orthopaedic and spinal work (with the exception of halo fixation devices), does not contraindicate magnetic resonance imaging; the procedure should, however, be stopped if patients experience pain in the region of large implants.[1] Ventricular shunts used to treat hydrocephalus and most haemostatic clips do not pose problems.

Nevertheless, clips used on intracranial aneurysms may undergo deflection in the magnetic field and exert a force considerably greater than arterial pressure: death from arterial rupture has occurred.[4] Some manufacturers use alloys not subject to deflection; the list of clips and other devices that are deflected is long,[5] and clinicians should consult radiological colleagues before referring patients for imaging. Recent statements from the Food and Drug Administration suggest that any doctors should hesitate to refer patients with any aneurysm clip: they may be misinformed about what has been used. Records should be kept, and patients should be informed of the manufacturer, model, and batch and serial numbers of any such clip; the Food and Drug Administration recommends an "alert card" or bracelet.[4] Magnetic resonance imaging should be deferred for at least six weeks after metal clips are applied to the fallopian tubes,[1] and in patients with the intravascular coils, stents, and filters that are increasingly used by interventional radiologists, to allow their firm incorporation into the vessel. Everybody should be quizzed about previous surgery and other interventions before they approach the imager—this is one of the many recom-