Increasing demands on today’s blood donors

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SUMMARY

Recently in Northern Ireland there has been a rapid increase in demand for a variety of blood components. To meet this need a large proportion of routine blood donations must be processed at the Transfusion Centre. In addition, several blood components are collected direct from donors by apheresis techniques. Apheresis is currently restricted to the collection of components from highly selected donors, but in future this method is likely to be employed for collection of some routine components. This changing pattern is placing increasing demands on many of our blood donors.

INTRODUCTION

Blood transfusion plays an essential role in modern medicine and surgery. Loss of blood, whether occurring spontaneously or as a result of trauma, can be rectified by the transfusion of whole blood or of concentrated red cells, a practice so well established as to be taken almost for granted. More recently, transfusion of particular components of blood has been introduced as part of the management of a wide variety of diseases. Indeed, whereas the usage of red cells has been increasing slowly, the demand for many of these other blood components has shown a dramatic upsurge in recent years. This upward trend applies particularly to platelet concentrates, fresh frozen plasma, and various plasma products, especially Factor VIII, albumin and certain immunoglobulins.

This development has placed additional burdens on the Blood Transfusion Service which is responsible for the production of components from donated blood. The huge increase in demand for blood components means that a high proportion of blood collected is now processed at the Transfusion Centre laboratories. The Table summarises the issues of blood and the major blood components to hospitals in the Province from 1974-84. It can be seen that, although blood donations have not been increasing during the past 6-7 years, the usage of most blood components has increased dramatically during the same period. The exception is cryoprecipitate, the usage of which has decreased as this product is gradually replaced by freeze-dried concentrates of Factor VIII for the treatment of haemophilia A. As in the rest of the UK, a proportion of the Factor VIII concentrate used in the Province has had to be imported, and the sudden increase in supply during the past year reflects a determined drive to become self-sufficient in this product.

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### TABLE

Issues of major blood components from NIBTS — 1974-1984

| Year     | Blood donations (Units) | Platelet concentrates (Units) | Factor VIII concentrates (International Units) (VIII pack) | Cryoprecipitate (80 KI Factor VIII pack) (Packs) | Albumin solutions (20 gm albumin/ bottle) |
|----------|-------------------------|-------------------------------|----------------------------------------------------------|------------------------------------------------|------------------------------------------|
| 1974     | 54,251                  | 882                           | NIL                                                      | 6,982                                        | 342                                      |
| 1976     | 61,882                  | 1,916                         | NIL                                                      | 10,629                                       | 1,533                                    |
| 1978     | 64,219                  | 3,166                         | NIL                                                      | 120,000                                      | 2,027                                    |
| 1980     | 66,401                  | 5,614                         | 1,574                                                    | 140,000                                      | 2,625                                    |
| 1981     | 64,135                  | 6,689                         | 2,365                                                    | 240,000                                      | 3,331                                    |
| 1982     | 63,310                  | 8,288                         | 4,943                                                    | 35,000                                       | 4,561                                    |
| 1983     | 62,428                  | 9,042                         | 4,883                                                    | 337,000                                      | 9,551                                    |
| 1984     | 66,500                  | 12,500                        | 4,750                                                    | 1,300,000                                    | 10,300                                   |

The projected 1984 figures are based on those available for the first nine months of the year. Albumin solutions include plasma protein solution, salting out poor albumin and prior to 1982, dried plasma.

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To meet the demand for Factor VIII concentrate (and other fractionated products), huge quantities of fresh frozen plasma must be collected, currently equivalent to approximately 35,000 donations per annum. This in turn depends on acceptance by clinicians of plasma-reduced blood for the majority of patients who require red cell transfusions. The production of purified plasma products requires special facilities and since 1982 fresh frozen plasma from Northern Ireland has been sent to the Protein Fractionation Centre, Edinburgh, for processing and purification.

While most blood products can be harvested from ordinary, single-blood donations, for some components there are advantages in direct collection from the donor. This applies particularly to those components which are found only rarely among the blood donor population, e.g. certain specific antibodies, or to those which are difficult to obtain in sufficiently high yield from conventional donations, e.g. granulocytes.

The main purpose of this article is to describe the organisation and precautions involved in setting up specialised blood donor panels for the collection of blood components and to highlight the increasing demands being placed on these donors.

**APHERESIS**

Collection of blood components direct from the donor is carried out by a procedure called apheresis which allows harvesting of the desired component while the remainder of the blood is transfused back to the donor. Apheresis procedures have a number of advantages over ordinary donations for the collection of components. Thus, not only are larger yields per donation obtained, but, because there is no significant red cell loss, donation can be carried out more frequently (commonly at monthly intervals). Apheresis can be carried out either manually, using a centrifuge to isolate the required component, or mechanically, using specially designed cell-separator machines. A large number of the latter devices which can be used to collect plasma, platelets or white cells direct from donors are now available. Although these procedures have become well established and are considered safe, they do tend to be fairly prolonged and entail having a needle in situ (one or both arms) for periods varying from 45 minutes to two hours. Furthermore, certain types of donors (e.g. anti-D donors) require to be immunised with foreign material prior to apheresis.

During the past few years, many apheresis donors have been recruited by the Northern Ireland Blood Transfusion Service. These donors are organised into separate panels according to the products obtained from their donations, i.e. cells (granulocytes and platelets), anti-D and other specific immunoglobulins.

**GRANULOCYTES AND PLATELETS**

Granulocyte transfusion is sometimes indicated for infected patients who are also severely granulocytopaenic. The need for transfusion arises particularly during the treatment of leukaemia when severe bacterial infection, which is unresponsive to antibiotics, is present. To make it effective, a large quantity of white cells is required, and this is best obtained by cytopheresis, using the automated cell-separator machine sited in the Royal Victoria Hospital.

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Platelets are normally obtained from single donations, but certain patients who become refractory to random-donor platelets may require platelets from HLA-matched donors. Invariably very few of the latter will be available, so the most practical method of collection is by plateletpheresis.

Granulocytes and single-donor platelets may be donated by relatives of the patient concerned. However, in many cases, suitable relatives cannot be found, and so in 1980 the NIBTS began recruitment of a panel of volunteers from the blood donor population. In order to avoid exerting undue moral pressure on existing donors, recruitment was carried out by a general publicity campaign rather than by a direct approach to individuals.

A code of practice for the organisation of such a panel of volunteers has been produced\(^1\) to which strict adherence is required. Before being admitted to the donor panel, each potential volunteer is provided with a detailed explanation of the procedure, including full information about any risks involved. The approval of their general practitioner is also sought. Those wishing to proceed are then asked to sign a consent form. Most donors are under the age of 40; this is desirable, as donors over this age should, according to the code of practice, have an ECG and chest X-ray prior to each donation. The donor panel has at present about 200 members who provide around 60 donations of granulocytes and/or platelets per year.

**ANTI-D IMMUNOGLOBULIN**

The almost complete prevention of haemolytic disease of the newborn by the routine administration of anti-D immunoglobulin to all Rhesus (D) negative women soon after the delivery of a Rhesus-positive baby (introduced in 1968) has been a major medical advance. The success of this programme has, however, led to some problems in providing the raw material (human plasma containing high titre anti-D) from which the immunoglobulin is produced. Until recently, the major source of this plasma were those Rhesus-negative women who had produced anti-D as a result of pregnancy. Now that this is successfully prevented in most cases, such individuals have become very few in number. The only alternative source is Rhesus-negative men who volunteer to be deliberately immunised with Rhesus-positive blood, so as to stimulate the production of anti-D antibodies. A panel of such donors has been recruited during the past year by the NIBTS in order to meet the demand for anti-D immunoglobulin in the Province.

As with cell donors, no direct approach was made to recruit existing donors to the panel, and fully informed written consent was obtained before admission. Since the procedure involves the administration of repeated small blood transfusions (1-2 ml), rigorous precautions must be taken to ensure that potential side-effects, e.g. hepatitis, production of unwanted red cell antibodies, etc., are prevented. Thus, in addition to the usual pre-donation tests, blood used for immunisation is selected from a specially accredited donor panel. The latter have exhaustive and frequent tests carried out to ensure as far as possible that their blood will not transmit any of the hepatitis viruses. Furthermore, the donor and recipient are matched for all clinically significant blood groups apart from the Rhesus (D) antigen. This is to ensure that no unwanted red cell antibodies are produced which might increase the difficulty in obtaining compatible blood, should the individual ever require a blood transfusion. To this end, volunteers are also encouraged to wear an identity bracelet which is designed to alert their medical attendants to the importance of transfusing Rhesus-negative blood.

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Once the anti-D titre has reached a sufficiently high level, plasma is collected by apheresis at about monthly intervals. Approximately 300 plasma donations per annum are required to meet current demand in the Province. This plasma is sent to the Protein Fractionation Centre, Edinburgh, for processing to anti-D immunoglobulin.

The future may see the introduction of antenatal prophylaxis of all Rhesus-negative women (to cover the occasional cases where antibodies are produced during pregnancy).2 This practice has been shown to be effective, but while clinically desirable, it would cause an enormous (fourfold) increase in the requirement for anti-D and consequently for many more immunised donors. Some would argue that the risks to donors (although extremely small) do not justify the relatively small benefit which might result.3

OTHER SPECIFIC IMMUNOGLOBULINS

In addition to anti-D, a number of other specific immunoglobulins are produced from human plasma containing a high titre of the appropriate antibody. These include anti-Hepatitis B, anti-Tetanus and anti-Varicella Zoster, etc., which are used for post-exposure prophylaxis in certain 'at risk' individuals. Suitable donors of the source plasma are extremely scarce, so, when identified by prior laboratory testing, they are encouraged to donate by plasmapheresis. About 300 such donations are collected per annum.

FUTURE DEVELOPMENTS

As indicated above, apheresis procedures have been used hitherto on a small scale, being restricted to highly selected donors. This is likely to change in the near future as the demand for blood components (e.g. platelet concentrates and certain plasma products) normally collected from random donors, continues to increase rapidly. Since the demand for red cells is growing much more slowly, it seems logical to augment supplies of these non-red cell products by the adoption of apheresis procedures on a proportion of the normal blood donor population. Until recently, the methods available have been too cumbersome, slow and costly to allow apheresis to be used on a large scale. Devices are now being produced which make this much more feasible and have already been used for the collection of large volumes of platelets and plasma in some centres.4

It is likely that the demand for blood components will continue to increase at least in the short-term. Eventually, it is quite possible, as developments in genetic engineering enable some of these products to be synthesised, that the requirement for blood components of human origin will decrease.

REFERENCES

1. Department of Health and Social Security. A code of practice for the clinical use of blood cell separators. (Working party report). London, 1976 (CSWP 26).
2. McClelland WM, McLoughlin KG. Prevention of Rhesus(D) immunisation — some causes of failure in Northern Ireland. *Ulster Med J* 1980; 49: 148.
3. Tovey LAD, Stephenson BJ, Townley A, Taverner J. The Yorkshire antenatal anti-D immunoglobulin trial in primigravidae. *Lancet* 1983; 2: 244.
4. Robinson EA. Single donor granulocytes and platelets. *Clinics in Haematology* 1984; 13: 185.

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