Blood banking in the Pacific

STEPHEN R WEINSTEIN MB BS *

Introduction

Despite recent advances in medical knowledge and accompanying explosive development in high-technology instrumentation, no adequate synthetic substitute has been found for human blood. Transfusion medicine has a continuing critical role to play in both acute life-threatening medical emergencies, as well as sustaining patients with a variety of chronic diseases resulting in symptomatic anaemia.

Blood banking in the Pacific involves some problems that are related to geographic isolation and scarce technological resources. In addition, other problems are plaguing transfusion services even in the most sophisticated and affluent health care systems. The latter include meeting rising demands for blood products from a shrinking pool of donors, and ensuring the safety of the blood supply from diseases agents like hepatitis B and HIV.

This paper outlines some of the challenges of blood banking in the Pacific through tracing the transfusion process from when blood is donated until it is transfused. The content is based on more than a decade of practice in the Pacific, from the isolation of Manihiki atoll in the northern Cook Islands, to the relative sophistication of Saipan in the Northern Mariana Islands.

Blood donor considerations

The most difficult problem facing any transfusion service seems to be ensuring a regular supply of blood donors. In most Western countries volunteer donors are the preferred mechanism, though occasionally this has to be supplemented by paid donors. In the Pacific, difficulties in recruiting sufficient volunteer donors is often ascribed to cultural factors. In practice, patients needing blood often need to rely on donations by family members (and occasionally refuse to have blood from anybody else). Disadvantages of this system are that there might not be enough friends or relatives with the correct compatible blood type, and in an emergency blood has to be drawn and tested, wasting precious time, rather than sitting in the refrigerator ready to be given immediately. A further problem with relying on family members is that normally strict donor health criteria have to be relaxed in order to get enough units of blood. It goes without saying that keeping a minimum number of emergency 0-negative ("universal donor") units available at all times is difficult.

With urbanisation, breakup of traditional extended families, and influx of tourists and contract workers, more sick or injured patients find themselves without readily available family members to donate blood. Some communities maintain lists of pre-tested individuals willing to donate blood in emergencies, thus shortening the preparation needed before transfusion. In the Northern Marianas Islands, donor shortages were partially addressed through organised volunteer blood drives, where groups such as Red Cross, Rotary, Chamber of Commerce, and government departments made exemplary contributions. Eventually regular blood supplies in Saipan were assured through a program of importing tested, screened units through the American Red Cross. The cost of this might however be prohibitive for many other Pacific countries.

> **" The most difficult problem facing any transfusion service seems to be ensuring a regular supply of blood donors. "**

Processing and storage

After a blood donor meets certain health criteria (age, temperature, blood pressure, and free from malignancies, cardiorespiratory disease and infections), about 450 ml (one pint) of blood is drawn. For a healthy adult this represents about 10% of the total blood volume, and can easily be given without suffering any symptoms or side-effects. Modern blood banking practice then requires this blood to be ABO and Rh typed, and tested for syphilis, hepatitis B and C, and Human Immunodeficiency Virus (HIV).

Testing blood for disease requires laboratory facilities, trained staff, instrumentation and limited-lifespan reagents[1]. Ensuring that instruments are working, and reagents are replenished before they become outdated is a recurring problem in laboratories around the Pacific. Most health administrators struggle to train and hold onto staff locally, versus the high cost of relying on recruited short-term contract staff.

* *Director of Pathology, Gold Coast Hospital, Southport Q 4215, Australia. Formerly Chief of Staff, Department of Health Services, Commonwealth of the Northern Mariana Is.*

The Pacific, is an endemic area for hepatitis B and thus a higher proportion of donated blood have to be discarded. Fortunately, HIV has not yet become common enough in the Pacific to threaten the blood supply[2]. In some countries (Japan and USA), donor blood is also tested for HTLV-1, a virus causing leukemia, but this has not been found frequently enough to warrant testing in the Pacific[3]. This situation is changing fast and it has become mandatory to test all blood for transfusion to exclude HIV.

Crossmatching and transfusion

Once drawn, the blood has a shelf-life of about 35 days, depending on nutrient additives. Theoretically, one unit of whole blood can be processed into at least four components, thus extending its utility through administering the specific product needed for a given medical condition. These components include: packed red blood cells (to correct anemia), fresh frozen plasma (for coagulation defects), platelets (formed clotting elements needed for hemostasis), antibodies, albumin, and others.

Separation of whole blood into components requires complex equipment, for example refrigerated centrifuges. This is outside the technological capability of most Pacific island blood banks. Whole blood or packed red cells are usually the only products available, and patients needing platelets or other factors often need to be treated off-island. Even storage of whole blood necessitates a special temperature-monitored refrigeration unit that keeps the temperature within a narrow range around +4 degrees centigrade, with alarm systems and constant graphic readout.

To crossmatch blood for a patient, a series of laboratory procedures are needed. The patients blood specimen is typed, and screened for "irregular antibodies" (uncommon antibodies that might cause a transfusion reaction). The patients serum is then "crossmatched" with the donor-blood red cells, to detect possible incompatibility. Even if apparently compatible blood is infused to the patient, transfusion reactions may occur for a variety of reasons. To recognise and treat transfusion reactions, which occasionally can be fatal, requires skilled medical and nursing staff. To perform a blood transfusion is a hazardous procedure, that should not be attempted outside a well-equipped hospital, except in case of extreme life-threatening emergency especially in the outer islands.

"Ensuring that instruments are working, and reagents are replenished before they become outdated is a recurring problem in laboratories around the Pacific."

The commonest indications for transfusion in Pacific appear to be acute trauma, including traffic accidents, blood loss associated with childbirth, surgical operations, and anaemia from renal failure (the latter reflecting the high incidence of diabetic kidney disease).

Administrative issues

In the USA, blood banks need to be inspected and licensed by at least three different government regulatory agencies (with overlapping accreditation requirements). This highlights the need for strict adherence to prescribed standards for reagents, equipments, testing procedures, and staff training. A more forgiving legal environment prevails in the Pacific, but certain minimum standard still have to be observed to make transfusion as safe as possible for patients. Most Micronesian jurisdictions attempt to follow the regulations of the American Association of Blood Banks, while countries in Polynesia and Melanesia often adhere to requirements followed in Australia and New Zealand.

Future prospects

Assuming no artificial blood substitute will be developed in the near future, there are still a few developments on the horizon that might lessen the need for homologous donor blood transfusion, which remains a risky and expensive medical intervention even under optimal circumstances.

Autologous transfusion refers to patients who are scheduled for elective surgery donating their own blood a few weeks before the operation, to be re-infused to them if needed. Autologous blood donation has received more attention recently because of the dangers of HIV and other transmissible diseases. Disadvantages are that it cannot be used for emergencies (since these are obviously unplanned!), and also that the patient-donor must meet certain health standards, which sick patients often fail to do. In practice, autologous donation can only reduce homologous blood need by about 10%.

Erythropoietin is a hormone produced in the kidney, which stimulated the bone-marrow to produce more red blood cells. It is certainly safer to make one's own blood than to receive someone else's, and this hormone has recently, through DNA recombinant technology, become available as a therapeutic drug. Its major use is to enhance blood production in patients with chronic disease, such as renal failure.

Decreasing the use of blood through staff education and stricter transfusion criteria can reduce transfusion requirements up to 30% without adversely affecting patient care[4]. It is very likely that more transfusions than strictly necessary are given world-wide, particularly in communities where health professionals are not specifically trained in transfusion medi-

cine. One way to decrease these inappropriate transfusions is an active hospital transfusion committee, representing doctors, nurses, laboratory staff and administrators, whose role includes assuring a regular safe blood supply, and its appropriate use according to a set criteria.

With relevant training and commitment, even smaller Pacific communities can make important advances in securing a safe and adequate blood supply, and there is ample evidence that this is happening in many places.

"With relevant training and commitment, even smaller Pacific communities can make important advances in securing a safe and adequate blood supply ..."

Conclusion

Blood transfusion is a complex process, involving initial donation, testing the blood unit for diseases, fractionation into components, storage, and finally crossmatching and infusion to the patient. In the Pacific Islands, blood banking presents additional challenges, at least some of which relate to staff training, laboratory procedures and equipment, and maintaining a pool of willing volunteer donors. Various countries have approached these problems in different ways, depending on their patients' needs and level of sophistication of their health care systems.

References

1. American Association of Blood Banks. *Technical Manual* (Tenth Edition), Arlington, Virginia: 1990.
2. Weinstein S. HIV-seroprevalence in the Northern Mariana Islands. *Asia-Pacific Journal of Public Health*, 1992/93; 6(4).
3. Weinstein S. Absence of HTLV-1 antibodies in a Northern Mariana blood donor population. *Transfusion*, 1992; 32(6):593.
4. Brandis K, Richards B, Ghent A and Weinstein S. A strategy to reduce inappropriate red blood cell transfusion. *Med J Aust*, 1994; 160:721–22. □