ABSTRACT

Objective: With a goal to establish strategies for improving blood safety in resource-limited conditions, the outcome of blood transfusion in a hospital setting of Cameroon was examined.

Methods: A 5-year descriptive and prospective study was conducted in which information on donor blood and recipients was obtained by direct patient observation and by examining patient notes in the various services of the hospital and records from the blood bank.

Results: Of 40,134 donations, 35,318 (88%) were from relatives or friends of recipients. Only 80% of all donated blood was considered safe for distribution. An average of about 20% of donated blood was rejected each year for positive human immunodeficiency virus (HIV) or hepatitis B antigen results. Other infections were not screened for. More than 50% of transfusions within the hospital were associated with an unfavorable outcome, predominantly febrile reactions and urticaria (40.1% and 19.4%, respectively). Acute intravascular hemolysis, circulatory overload, and deaths occurred in 0.01%, 0.04%, and 0.14% of cases, respectively. A case of post-transfusion HIV infection was also detected.

Conclusions: Blood transfusion is still unsafe in many resource-limited communities of developing countries. However, it is possible to reduce some of these complications without sophisticated technology. Efforts to recruit more benevolent and autologous donors in the communities are essential.

Key Words: Cameroon, donors, recipients, resource-limited, transfusion, unfavorable outcome


The use of blood and blood products is an indispensable aspect of therapeutic medicine; so much so that blood transfusion currently is considered a full sub-speciality in its own right. Nevertheless, this important therapy may be associated with complications, such as immunologic, infectious, or metabolic accidents. These complications are sometimes immediate (occurring during or just after transfusion) and are sometimes delayed (occurring days or weeks later). Despite all precautions taken to render blood 100% safe, most countries of the developing world still report the highest numbers of fatal complications linked to blood transfusion therapy. The predominance of hospital-based blood banks in the communities rely on family donors rather than regular benevolent donors; this aggravates the situation. This analysis was undertaken to evaluate the outcome of blood transfusion in a hospital setting of Yaoundé, Cameroon, where a blood bank of this type functions with limited resources and structures and few trained personnel.

DESIGN AND METHODS

A 5-year descriptive and prospective study was carried out in one of the biggest teaching hospitals of Cameroon, Hôpital Central Yaoundé (HCY) between 1994 and 1998. The hospital currently has a bed capacity of 478 beds. It also caters for the medical needs of most of the city of Yaoundé and its environs.

In Cameroon, each hospital or Health Institution tends to run an autonomous blood supply unit (a mini blood bank), because there is no national blood transfusion service. Thus, in addition to all the other services of HCY, there is a blood bank from which the majority of blood for transfusion is distributed to centers that serve the population of Yaoundé and to neighboring health institutions. Since there is no temperature-controlled centrifuge available, sedimentation by gravity is the procedure used to obtain red cell concentrates, and when they are required, transfusion of the unit is interrupted once the red cells have all been transfused. The screening tests routinely done on donated blood include screening for infectious diseases (Australian antigen for hepatitis B [HBsAg], human immunodeficiency virus [HIV], and Treponema pallidum [syphilis]) and ABO and Rh D (RhD) blood group testing. Screening for hepatitis C virus (HCV), cytomegalovirus (CMV), and others is not carried out in this center. A minor compatibility test is always performed between the donor plasma and patient red cells prior to transfusion, but major compatibility testing is not carried out in this center. This blood bank tends to keep daily records (registers) of all blood donated with respect to the results of screening.
tests, blood group, blood request forms, and blood distribution. The destination of any blood is usually specified; thus, with some effort, it is possible to trace it to the recipient. Any incidents during transfusion tend to be reported to the blood bank or recorded in the patient notes, but there is no organized system available to ensure that no information is lost.

Between January 1994 and December 1998 records for all blood donations were examined for relevant information on the various screening tests performed on each pint of blood, their ABO or Rh blood groups, the total number of pints distributed or eliminated, and any accidents or incidents associated with the transfusions undertaken within the hospital. Information was also obtained from patient records, after verbal consent from the heads of the various services, on the management and evolution of the complications that occurred as well as the final outcome of the transfusion. All relevant data were copied on to pre-established work sheets for analyses.

**RESULTS**

Of 40,134 units of blood collected over the past 5 years, 35,318 (88%) were donated by family members or friends of the recipients. Only 32,107 pints (79.89 ± 4.04% of total blood collected) were considered safe and distributed for use, an average of 6,421 ± 567.8 units per annum. Approximately 20% of all donations were rejected each year after screening for infectious agents: 5.08 ± 0.81% with HIV antibodies detected and 15.02 ± 3.52% positive for the HbsAg screening test. A total of 26,973 pints (84% of all the distributed blood) was used within the hospital itself (Table 1); the rest was distributed to neighboring health centers and hospitals. During the study period, more than 50% of the transfusions were associated with an unfavorable outcome, with a peak noticed in 1995 (85% of all transfusions) and a steady decline over the following years (Table 2).

**Gender and Age Distribution**

Among the blood recipients, 59.2% were female and 40.8% male. Patients younger than 15 years of age (pediatric ages) constituted 63.5% of all recipients.

**Blood-Group Distribution**

Blood groups O, A, B, and AB were respectively distributed to 60%, 22%, 14%, and 4% of the recipients. About 2% of cases were Rh negative.

**Indications for Transfusion**

Most transfusions were administered in pediatric cases (<15 y) (17,128 units, 63.5% of all blood used within HCY). Indications for transfusion in this group included...
malaria (as the sole cause of anemia) in 38.7% of cases; sickle cell anemia in 35.5% of cases, and nutritional anemia in 11.6% of cases. The rest of the pediatric cases (14.2%) were transfused for other causes, such as infections, including HIV and acquired immunodeficiency syndrome (AIDS), intestinal parasites, and childhood leukemia and other malignancies.

About 18% of blood (4855 units) was distributed to recipients from the obstetrics and gynecology unit and was transfused mainly after hemorrhage from abortion, ruptured extra-uterine pregnancy and other third-trimester bleeding, and following cesarean section. The remaining 18.5% (4990 units) was used in the medicine and surgery units, usually in recipients with digestive hemorrhages, cancers, AIDS, and other chronic diseases associated with anemia. A few cases in surgery were transfused as a preventive measure prior to surgery.

### Previous Transfusions

Most of the patients with sickle cell anemia (93%) had received at least one previous transfusion, compared to 24% of the patients with malaria. The majority of cases of hematologic and other malignancies had also previously received a transfusion.

### Unfavorable Outcome of Transfusion

As shown in Table 2, the most frequent unfavorable occurrences noted were febrile reactions (40.1%) and urticaria (19.4%). These findings were noted most often in persons with a history of blood transfusion. These reactions usually occurred within the first 60 to 90 minutes after the start of transfusion. There were no cases of hypothermia observed. Although relatively rare, an acute hemolytic reaction (AH R), from incompatible ABO blood group transfusions, was reported in 0.01% of cases; of the four, two patients died. Circulatory overload, usually with acute pulmonary edema (APE) was noted in 12 recipients (0.04%), with a subsequent fatal outcome in seven cases. In four cases, APE was attributable to transfusion of whole blood to severely chronically anemic patients with heart failure and chronic renal failure. Death occurred in 0.14% of cases either during or shortly after transfusion (within a couple of hours). In patient records, these deaths were attributed to a variety of causes, including shock and disseminated intravascular coagulation (DIC) following AHR, acute renal failure, and APE. In one case of sickle cell anemia, the child died suddenly during the course of the transfusion, and no precise cause was determined.

### DISCUSSION

It is understandable that febrile reactions were the most common outcome noted in blood recipients within HCY. Febrile reactions, among other causes, may be attributable to incompatible white cells, owing to release of pyrogens from recipient granulocytes and monocytes. Thus, antileukocyte, anti-human leukocyte antigen (HLA) and other irregular antibodies are developed, usually in multiparous women and those with previous blood transfusions. Leukocyte depletion is not done at all in Cameroon, increasing the risk of antigranulocyte antibodies being developed in repeatedly transfused individuals. Furthermore, donor blood is not screened for malaria parasites. Nevertheless, with malaria being endemic in Cameroon, the parasite may be transfused directly to recipients at various stages of its life cycle within the blood stream, causing fever. In a pilot study of the prevalence of malaria parasites among donated blood units in a transfusion service, about 80% of the units contained malaria parasites (Binam F Personal communication). No case of fever was attributed to bacterial pyrogens from transfusion of blood contaminated with bacteria.

The frequent occurrence of urticaria and pruritus, a manifestation of allergy, may result from the presence of foreign proteins in the donor plasma, because whole blood is the major type of blood product transfused in HCY (approximately 84%), irrespective of the clinical status of the recipient. Filarial proteins in donor plasma (Loa loa and Onchocerca volvulus infections) may also contribute significantly to the occurrence of urticaria and pruritus, since these are highly prevalent in Cameroon. In addition, blood separation to obtain red cell concentrates currently is entirely dependent on the effect of gravity on a unit of whole blood. Sometimes nurses who administer blood transfusions do not remember to stop the procedure as soon as all red cells have been transfused. Thus, substantial amounts of plasma and plasma proteins are always inevitably transfused. This further explains the occurrence of APE in some patients with chronic anemia, chronic renal failure, and heart disease. The use of phenotyped red cells in persons who are subject to repeated transfusions is not practiced because of the limited resources. In 1990, Vichinsky and colleagues observed that more alloimmunization with red cell antibodies occurred in multiply transfused people with hemoglobinopathy in Africa. The absence of hypothermia observed may be explained by the frequent and unacceptable practice in this hospital of warming blood units at uncontrolled temperatures and duration before use.

The risk of transmission of various infections through blood transfusion is well documented and may account for an estimated average of 10% of all HIV infections in sub-Saharan Africa. A prevalence of 4.1% for HIV infection was reported among blood donors in Yaoundé in 1990, this being an increase from 0.36% observed in 1987 (Sentinel Surveillance of the Ministry of Public Health of Cameroon, 1990). Meanwhile a prevalence of 10 to 15% for HbsAg was described in blood donors in Yaoundé.
With the possibility of a negative screening test during the pre-serologic phase of the HIV cycle, and especially with the existence of new strains of the virus (O and N subtypes), a high incidence of transmission should be expected. However, only one case of HIV transmission through transfusion was recorded in this study. This may be explained by the fact that few people are screened for HIV as a routine test prior to transfusion and by the possible existence of the serologic window in some of the donated blood.

Although no case of HCV infection was recorded in this study, screening for this virus is not being carried out in this blood bank. A prevalence of 13% in parts of Cameroon had been reported, and screening for the HCV in a group of homozygous patients with sickle cell anemia who had received several blood transfusions in Yaoundé showed a prevalence of 23.91% among them. Thus, it is likely that many get this infection from transfusions in this setting. In fact it is believed to be responsible for 80 to 90% of post-transfusion hepatitis.

No information is available on CMV, human T-cell lymphotropic virus type I and type II (HTLV-I and -II), and other such infections in this blood bank. Infections such as malaria were not included in any records. Cameroon is endemic for Plasmodium falciparum malaria; thus, it is not considered cost-effective to screen donor blood for malaria parasites prior to transfusion. Nevertheless, malaria is believed to be common in this setting following transfusion.

Four cases of acute hemolytic reaction attributable to ABO incompatible blood transfusions were recorded, two of which had fatal outcomes. Fatal cases of APE were also recorded. These suggest that the human factor (recording and verification of blood groups, supervision of transfusion, and intervention at the slightest manifestation ...) has a vital influence on the outcome of blood transfusion. Major compatibility testing would also reduce the prevalence of such accidents. No cases of delayed hemolytic reactions were recorded. This may be explained by the fact that many patients tend to be lost to follow-up. Thus, available information is usually on immediate transfusion accidents (same day incidents). In most instances the patients may not associate late symptoms with the transfusions.

CONCLUSIONS

The management of blood transfusion in most developing countries faces numerous problems, including the lack of infrastructure, organizational and logistic capabilities, and adequate numbers of trained personnel. Many complications and deaths from blood transfusions are preventable without need for sophisticated equipment. It is important to continuously educate staff on basic aspects of transfusion therapy, and the strict implementation of practical international norms would go a long way to improve the situation. Blood donations tend to be sporadic, and donors are more often family or friends of recipients than regular and benevolent donors as recommended by the World Health Organization. In addition, hospital-based transfusion systems have been shown to be not only not economical, as demonstrated by an average of 20% bags destroyed annually in this case, after testing but also more difficult to manage, and they tend to be unsafe. Although more trained and committed personnel are needed in this field to reduce preventable negative effects of transfusion, international organizations should continue to sponsor and supervise developing countries in creating organized national blood transfusion services to enhance blood safety for all.

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REFERENCES