

# Blood Transfusion: The Risks and Benefits

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*As greater attention is focused on medical and legal risks of the transfusion process, physicians ordering a blood transfusion must advise their patients thoroughly and clearly of the potential risks involved. Physicians must explain clearly to patients that a zero-risk blood supply is impossible to achieve; patients must understand that all necessary steps practicable have been taken to ensure the safest possible supply.*

## Introduction

Blood transfusion is not a perfectly safe procedure; however, neither is omitting transfusion for a patient at risk of dying of anemia or bleeding.<sup>1</sup>

A statement issued at the National Institutes of Health Consensus Development Conference in June 1988 made this observation: "Transfusion is a lifesaving measure in the management of a variety of medical and surgical conditions...For many patients, homologous red cell transfusion carries great benefits, permitting surgical procedures that would not otherwise be possible, and allowing medical therapies for patients who are or may become anemic."<sup>2</sup>

In her article "Explaining Benefits of Transfusion," Linda Stehling MD states, "The physician must ask, 'What is the goal of therapy?' ...The goal must be to benefit the patient in some way. The alternatives must also be considered."<sup>3</sup>

Since several alternatives to transfusion are available, the patient should be given an explanation of both the positive and negative aspects of each as it relates to his or her particular situation.

Three techniques are involved in blood conservation: Reduction of blood loss both during surgery and for diagnostic purposes; minimizing transfusion of blood and components, accomplished by hemodilution; and autologous blood transfusion.

## Risks of transfusion transmitted disease

According to Roger Y. Dodd PhD, American Red Cross Holland Laboratories, "The safety of the blood supply continues to increase, not only as a result of major innovations such as the elimination of paid donations [in the 1970s] and the introduction of new tests [in the 1980s], but also because of incremental improvements in test sensitivity and refinements in the process of education donors and assessing their qualifications."<sup>4</sup>

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Submitted for publication: December 21, 1992

## Areas of concern in transfusion

Risk associated with transfusion can be either immediate or long-term and includes both immunologic and infectious disease consequences. Areas of particular concern that the physician should discuss with the patient are:

- Hemolytic transfusion reactions ranging from fever and chills to death.
- Transmission of infectious diseases such as hepatitis or AIDS.
- Febrile reactions causing temporary increase in body temperature.
- Immune problems ranging from urticaria to breathing difficulties or, on rare occasions, donor inability to accept homologous blood without becoming ill.

## Transfusion risk projection

Many reports in medical literature now available assess the risk of transmission of infectious diseases by blood transfusion, in particular HIV. The projection of risk usually has been determined in one of 3 ways:

- Actual cases of transfusion-transmitted AIDS (since mid-1985, when the test for HIV was applied to all donated blood).
- Reports from investigative techniques such as polymerase chain reaction (PCR) and viral cultures of tested donor blood.
- Studies projecting probable risks of infection based on epidemiologic models.

## Actual case studies

In a six-year study of transfusion-transmitted hepatitis C in cardiac surgery patients, as reported in the *New England Journal of Medicine*, investigators at Johns Hopkins, Baylor, and St. Lukes in Houston found the incidence to have decreased markedly (84%) since implementation of hepatitis C virus testing in May 1990.<sup>5</sup>

The authors estimated the risk of transfusion-transmitted hepatitis C at 3 per 10,000 units transfused, based on finding 3 seroconversions in 552 patients who received 9,916 units of blood that had been tested and were negative by the first generation HCV test. The risk is lower now with the improved sensitivity of the second generation test for HCV which has been in use by all U.S. blood banks since March 1992.

In the same study (reported completely in the *Annals of Internal Medicine*, October 1, 1992) the risks of transfusion-transmitted HIV-1 and HIV-1/2 from screened blood were found

to be about one in 60,000 units transfused. A total of 11,532 surgery patients were followed at the 3 institutions to determine the incidence of transfusion-transmitted disease. These patients had received 120,301 units of blood or blood components and 2 of the patients were infected with HIV-1, for a risk of approximately 1 in 60,000 units of blood. The authors felt the current risk of transfusion-transmitted AIDS from blood that had tested negative for HIV is probably lower today because of improved sensitivity of the tests now in use, coupled with more effective exclusion of high risk donors. Both infected patients had been transfused prior to 1990. The seroconversion for HTLV-I/II was 1 in 69,272 units.

Another report of AIDS transmission from blood screened negative for antibody to HIV is found in the *New England Journal of Medicine* (May 28, 1992). The authors, from the Centers for Disease Control, describe results of investigating 158 reports that CDC had received of patients with transfusion-transmitted AIDS from negatively screened blood.<sup>6</sup>

In this investigation, 98 patients had completed follow-up, 14 other cases had information that removed them from the study (eg, transfusion in a foreign country) and 47 cases are still open for further investigation. Of the 98 patients with a completed follow-up, only 15 had actually been exposed to HIV through the receipt of blood from donors who initially tested negative for HIV antibody and were later confirmed to be infected with HIV.

To date, no cases of transfusion-transmitted AIDS from blood tested for HIV have been reported in Hawaii.

### Investigative techniques

Another way to determine risk of transfusion-transmitted HIV is to culture peripheral blood mononuclear cells and perform genetic amplification with PCR in fully screened HIV-negative blood donors, seeking evidence of HIV.

In a report published in *New England Journal of Medicine* (July 4, 1991) from the University of California-San Francisco and the Irwin Memorial Blood Center, HIV was found in one of 76,500 donations that underwent culture and PCR in a 2-year period (November 1987 to December 1989). According to the authors, "Given the similarity between the rate of HIV-I seropositive donations in San Francisco to date (0.01%) and the rates in most other cities around the country, the risk we observed is probably comparable to that in other major metropolitan areas. It is noteworthy that our estimate lies within the confidence intervals of recent projections based on epidemiological models, as well as within the confidence intervals of a prospective follow-up study of recipients of screened blood. Collectively these results put into perspective the low risk of HIV-I transmission by transfusion of fully screened blood."<sup>7</sup>

### Epidemiologic model studies

Dodd notes that an analysis of data on the infectivity of the last seronegative blood donation from donors who subsequently became positive suggests that the infectious-window period for HIV is about 45 days and that the overall risk of infection is one in 225,000 units. He compares this figure to higher estimates of one in 60,000 based on isolation of HIV of seroconversion of recipients in locations where the prevalence of HIV is relatively

high. Based on surveillance studies and efficiency of laboratory tests, he estimates the frequency of transfusion-transmitted hepatitis B at one in 200,000 units.<sup>4</sup>

Other rare infections, such as *Yersinia enterocolitica*, malaria, *Babesia microti*, and *Trypanosoma cruzi*, are reported rarely in the United States, with a risk of less than one in 1 million units. One author, Ira A. Shulman MD, notes that only 5 cases of transmission of such parasitic infections have occurred in one year in the United States out of more than 12 million units of blood collected and transfused.<sup>8</sup>

Noninfectious adverse reactions to blood transfusion and their reported frequency are: Fever/chills, 1-in-50 to 1-in-100; urticaria, 1-in-100; hemolytic transfusion reaction, 1 in 6,000; fatal hemolytic transfusion reaction, 1 in 100,000.<sup>9</sup>

### Autologous donation—an overview

In the quest for maximum safety in blood transfusion, a strong case exists for encouraging autologous donation as the optimal transfusion alternative. A recipient who serves as his or her own donor receives the safest possible transfusion in that the risks of transfusion-transmitted infection and alloimmunization are eliminated. Patients who donate their own blood for use in their own elective surgery reduce their risk for immune reactions and infectious diseases associated with allogeneic transfusion.<sup>10</sup>

The Blood Bank of Hawaii has been providing autologous donation as a service to Hawaii patients since the 1970s and currently performs more than 100 procedures annually. A patient's blood is not drawn if the Blood Bank's medical director determines the procedure has potential to cause harm to the patient.

Other health care institutions that provide autologous donation service include The Queen's Medical Center, Kaiser Permanente Medical Center, Kuakini Medical Center, St. Francis Medical Center, Maui Memorial Hospital, and Hilo Hospital. The number of procedures performed by these institutions ranges from more than 700 to fewer than 50 annually depending on hospital size and need.

### Eligibility criteria

In general, a patient healthy enough to undergo a planned surgical procedure usually can tolerate phlebotomy. The patient must have a minimal hemoglobin level of 11 g/dl or a hematocrit of 34%, and the frequency of donation can be no more than every 4 days to allow for equilibration of plasma volume. It is best to collect blood as far in advance of the intended date of surgery as possible to allow the patient's hematocrit to return to pre-donation levels, and patients are deferred from donating if any of the following conditions exists:

- Severe hypertension
- Cardiac symptoms such as angina or arrhythmia
- Severe aortic stenosis
- Recent myocardial infarction or active cardiac failure
- Active infection
- Positive test for HIV or HBsAg.

### Benefits of autologous donation

According to Robert L. Thurer MD and Margot S. Kruskall MD in "Alternatives to Random-Donor Transfusion," "Autolo-

gous donation can have very important benefits in the appropriate patient population, since exposure to homologous blood usually can be reduced or eliminated. A second effect, possibly advantageous and deserving more study, is a higher hematocrit during surgery and hospitalization, due partly to the erythropoietic stimulus of phlebotomy and partly to the greater likelihood that red cells will be given if autologous units are available."<sup>11</sup>

Benefits of autologous transfusion for the donor-patient are numerous, and a physician should explain clearly to the patient that this procedure:

- Eliminates transmission of infectious disease
- Eliminates risk of alloimmunization to erythrocyte, leukocyte, platelet or protein antigens
- Eliminates risk of hemolytic, febrile or allergic reactions due to alloantibodies
- Eliminates risk of graft-versus-host reactions
- Stimulates erythropoiesis by repeated preoperative phlebotomy
- Reduces the quantity of homologous blood used in a given procedure.

### Risks of autologous donation

The drawbacks to autologous donation are limited and for the most part of minor significance:

- Potential exists for presurgical anemia or hypovolemia<sup>12</sup>
- Potential exists for human error and mix-up of blood units prior to transfusion.

Additionally, according to Thurer and Kruskall, "Collecting and transfusing autologous blood is unnecessary and inappropriate for those surgical procedures that seldom require transfusion. Medical facilities and fiscal resources are strained when patients donate autologous blood that will not be used."<sup>13</sup>

"The most important option [for the physician] is to do everything possible to make transfusion unnecessary, to eliminate the transfusion experience...The first question to be considered for any patient is, 'Is the transfusion necessary?'"<sup>11</sup>

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