Bacterial contamination of blood components: Is it in the bag?

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A patient with leukemia experiences fever and chills 2 hours after receiving a platelet transfusion. *Staphylococcus epidermidis* grows in both central-line and peripheral blood cultures. The resident initiates treatment with vancomycin, considers removing the central line and orders a culture of the platelet bag. An identical strain of *S. epidermidis* is isolated from the bag.

Although the scenario related here is fictitious, health care workers may be surprised to learn that bacterial contamination of blood components can occur and that, for platelets, contamination with bacteria is more common than contamination with viruses such as HIV (1 in 913 000 units) and hepatitis C virus (1 in 103 000 units)[1–4] (Table 1). It is likely that, because of lack of awareness, only a small number of all transfusion-related infections are reported in Canada. Under-reporting of platelet-related infections may be especially prevalent, because the organisms identified are typically judged to be skin contaminants or related to indwelling catheters. The cost of culturing samples from the transfusion bag of every febrile recipient may be a financial impediment to identifying these infections. However, leukoreduction (removal of leukocytes by filtration) is now applied to platelet units, and the occurrence of noninfectious febrile reactions has decreased dramatically. Therefore, the proportion of such reactions due to bacteria will now be larger, and culturing blood component bags will have a greater positive predictive value.

The symptoms and signs of transfusion-related bacterial infection are nonspecific and may mimic noninfectious transfusion reactions[1,2] (see text box). Severe reactions are more common after receipt of contaminated erythrocytes, because more virulent gram-negative bacteria are involved. Platelet recipients are often immunocompromised and may also suffer severe sequelae.

When these reactions are suspected, samples from blood component bags should be cultured, and bacteria grown from the bag should be compared with those isolated from the patient. Adverse reactions that may be due to bacteria should be reported to the hospital transfusion medicine service. Investigation will then be undertaken by the hospital, the blood supplier (Canadian Blood Services or HémaQuébec) and federal regulators to determine the source of contamination, withdraw potentially contaminated blood and identify exposed patients. To prevent blood contaminated with infectious agents from entering the Canadian system, potential donors with fever, symptoms of illness or a history of recent dental work are deferred, and donors are asked to notify the blood service if illness develops within the week after donation.

Methods to detect or destroy bacteria in donated blood components are available, but none is widely accepted for

Note: The opinions expressed in this article are those of the authors and do not necessarily reflect those of Health Canada.

Table 1: Overview of bacterial contamination of blood components

Blood component	Approximate prevalence of contamination	Mortality rate, %*	Primary source of contamination	Common organisms
Platelets	1 in 2000 units[5]†	26[1]	Donor skin	*Staphylococcus epidermidis, S. aureus,* other coagulase-negative staphylococci, *Bacillus* spp.
Erythrocytes	1 in 500 000 units[6]	71[1]	Donor bacteremia	*Yersinia enterocolitica, Pseudomonas* spp. (cold-loving bacteria)

*Data are based on case reports, and there may be selection bias toward more severe cases with greater risk of death.
†In this study 16 of 31 160 randomly selected donor units had positive results when cultured prospectively. The reported prevalence of contamination has generally been lower in studies in which only units given to symptomatic patients were cultured.[2]

routine use. "Low-tech" approaches include visual inspection, gram staining, culture, and measurement of pH and glucose by dipstick. "High-tech" approaches under study in Canada and the US include ribosomal probes and polymerase chain reaction.[1] Psoralens, chemicals that bind to bacterial nucleic acids to prevent replication and inactivate bacteria,[1] are in phase II clinical trials in the US. Leukoreduction — now standard for decontamination of platelet units and soon to be used to prepare all blood components in Canada — appears to reduce *Yersinia* contamination, although results with skin organisms are equivocal.[1] Addition of antibiotics to blood might appear to be another solution, but the potential for fatal drug reactions in recipients and for increased antibiotic resistance represent unacceptable risks.

Improved recognition and reporting are needed to better gauge the magnitude of transfusion-related bacterial infections and to institute appropriate treatment, prevention and control measures. Justice Horace Krever recommended that it become "a standard of practice that physicians report adverse reactions from transfusion of blood components."[7] Those responsible for blood safety must work with physicians to make this vision a reality.

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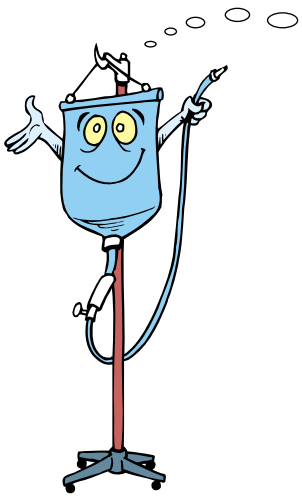
Culture needed!



Culture me when any of the following occur during, or within 2 hours of, a transfusion:[1,2]

- fever (temperature 38.0°C or higher) or an increase in temperature of more than 1.0°C
- tachycardia (heart rate ≥ 120/min) or an increase in heart rate of more than 30/min
- shaking chills
- hypotension (drop in systolic blood pressure of more than 30 mm Hg)
- nausea, vomiting, diarrhea, dyspnea, bleeding, oliguria or other symptoms of shock