Frequently Asked Question: Can a sample be submitted for DNA extraction/testing after a patient has had a blood transfusion?

Summary:
The Molecular Genetics Laboratory (MGL) recommends that blood collection for DNA extraction be deferred until at least 1 week after transfusion. If this is not possible, with the exception of requests for chimerism studies, we **will** accept blood samples from individuals who have recently received most blood products for genetic testing.

Detailed discussion:
Upon receipt of a peripheral blood sample in MGL, and when indicated, DNA is extracted from leukocytes (white blood cells). Whether or not the DNA extraction will be contaminated with DNA from the blood donor(s), then, depends on the number of donor leukocytes that are present in the blood of the transfusion recipient at the time their blood is collected for DNA extraction.

Whole blood transfusions are rare; most blood transfusions today are done with licensed blood components taken from whole blood donations[1]. In Canada, all whole blood donations undergo filtration to remove donor leukocytes (i.e., they are "leukocyte reduced"). Plasma and platelets can also be donated using a filtration process (plasma- or plateletpheresis, respectively) that collects only the component of blood of interest, returning the remaining donor blood components to the donor[2]. Despite these filtration processes, however, some donor leukocytes will remain in the blood products that will be transfused into recipients[3].

Studies have shown that, in recipients of blood products that have **not** been irradiated, there is a spike in the number of donor leukocytes present in recipient blood approximately 3 to 5 days after transfusion. This spike is thought to be due to the proliferation of donor leukocytes after transfusion[4,5]. However, in immunocompetent individuals, donor leukocytes are quickly identified and eliminated through an immunologic attack: one week after transfusion, donor leukocytes are not generally detectable in the blood of transfusion recipients[6,7] unless the test method is highly sensitive to the presence of very low numbers of donor cells[8].

In addition to leukocyte reduction, for certain patients, blood products are also irradiated prior to transfusion[9]. Irradiation decreases the number of viable donor lymphocytes in the blood product by damaging the nuclear DNA in these cells. Irradiation, therefore, prevents the proliferation of the donor leukocytes after transfusion[10] and donor leukocytes would be expected to be eliminated even more rapidly by the transfusion recipient's immune system.

In general, blood products given to immunocompromised individuals will be irradiated[11]. Therefore, donor leukocyte survival is unlikely to result in significant contamination of the DNA extraction.

In addition to considering the blood product given to the patient, the nature of the DNA testing being requested may also impact the suitability of blood from a recent transfusion recipient. The vast majority of the tests performed in MGL are expected to reveal only rare changes in the DNA of individuals with the condition(s) of interest[12]. Therefore, the

likelihood that an individual's test results could be compromised by using DNA contaminated with DNA from a blood donor is expected to be very low for the majority of our tests. To minimize the risk of contamination, we recommend waiting at least 1 week after transfusion before collecting blood whenever possible. When sample collection cannot be delayed, however, the results our tests (except chimerism studies) are unlikely to be affected.

Unlike most of the tests available in MGL, chimerism studies for bone marrow transplant monitoring may be impacted by the presence of blood donor DNA. This analysis is semiquantitative and is able detect a second cell line when that cell line represents at least 10% of the total cell population. Therefore, while unlikely, DNA extracted transfused patients may not be suitable for this analysis. Contact MGL to discuss.

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[1] Canadian Blood Services Website: "From Vein to Vein." Accessed May 2, 2012. [http://www.blood.ca/centreapps/internet/uw_v502_mainengine.nsf/page/Where%20Does%20Blood%20Go?OpenDocument].

[2] Canadian Blood Services Website: "Types of Donations." Accessed May 2, 2012. [http://www.blood.ca/centreapps/internet/uw_v502_mainengine.nsf/page/Types%20of%20Donations].

[3] Canadian Blood Services. (2011). *Circular of Information For the Use of Human Blood Components: Red Blood Cells, Leukocytes Reduced (LR).*

[4] Lee, T.-H., et. al. (1995). Transient increase in circulating donor leukocytes after allogenic transfusions in immunocompetent recipients compatible with donor cell proliferation. *Blood, 85*: 1207-14.

[5] Lee, T.-H., et al. (1999). Survival of donor leukocyte subpopulations in immunocompetent transfusion recipients: Frequent long-term microchimerism in severe trauma patients. *Blood, 93*: 3124-39.

[6] Wenk, R.E. & Chiafari, F.A. (1997). DNA typing of recipient blood after massive transfusion. *Transfusion, 37*: 1108-10.

[7] Adams, P.T. et al. (1992). Detection of circulating donor white blood cells in patients receiving multiple transfusions. *Blood, 80*: 551-5.

[8] Lee, T.-H., et. al. (1999). Survival of donor leukocyte subpopulations in immunocompetent transfusion recipients: Frequent long-term microchimerism in severe trauma patients. *Blood, 93*: 3124-39.

[9] BC Provincial Blood Coordinating Office. (2007). *Transfusion Medicine Medical Policy Manual: 6.2. Indications for Irradiation of Blood Components.*

[10] Canadian Blood Services. (2007). *Clinical Guide to Transfusion: Chapter 15 – CMV Seronegative, Irradiated and Washed Blood Components.*

[11] BC Provincial Blood Coordinating Office. (2007). *Transfusion Medicine Medical Policy Manual: 6.2. Indications for Irradiation of Blood Components.*

[12] T. Nelson, Associate Director, Molecular Genetics Laboratory, Personal Communication.