Saint Luke's REGIONAL LABORATORIES

Clinical Laboratory News

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CMV Safe Blood Components

Cytomegalovirus (CMV) is a DNA virus of the herpesvirus family. Transfusion acquired CMV is of little concern in immunocompetent individuals, but can be a serious problem in immunocompromised patients. In the latter group of patients, CMV transmission can result in pneumonitis, hepatitis, gastroenteritis, chorioretinitis, or disseminated disease. CMV negative blood components are indicated for fetal and intrauterine transfusions, low birth weight premature infants born to CMV seronegative mothers and CMV negative recipients of organ, peripheral blood stem cell or bone marrow transplants from CMV negative donors.

Between 50 and 80% of the US population has been infected with CMV. Traditionally, blood banks test donors for antibodies to CMV to try to prevent viral transmission to immunocompromised patients. Labelling a unit as seronegative indicates that the unit does not contain detectable antibodies against CMV, but does not mean the unit cannot transmit CMV. A donor with a recent infection can harbor virus in their plasma or white blood cells even though they test negative for antibodies. The window period for CMV infection is estimated to be 6 to 8 weeks. As with all laboratory tests, there is the possibility of a false-negative antibody test in an infected donor.

In established infections, CMV resides in a small minority of monocytes. This means that risk of CMV transmission can be greatly diminished by leukocyte reduction of donor units, which removes at least 99.9% of leukocytes. Studies have estimated that fewer than 25 potentially infected monocytes remain following leukocyte reduction by either filtration or apheresis. During the viremic phase of an acute infection, some virus may circulate in the plasma and not be removed by leukocyte reduction. Neither antibody testing or leukocyte reduction will prevent transmission of CMV in this scenario.

In 1995, the Bowden study compared CMV transmission rates in bone marrow transplant recipients receiving either CMV seronegative or filtered blood products (Blood, Vol 86, No 9, 1995: pp 3598-3603). This study did not detect any significant difference in CMV transmission between either group.

Since 1997, AABB has considered leukocyte reduced blood to be a CMV safe product that is equivalent to CMV seronegative units for preventing CMV transmission. The Circular of Information for the Use of Human Blood and Blood Components (prepared jointly by AABB, American Red Cross, America's Blood Centers and Armed Services Blood Program and recognized by FDA) lists leukocyte reduction as an alternative to CMV seronegative products.

Filtration technology for leukocyte reduction has greatly improved since publication of the original study. Today all red cell units are leukocyte reduced by filtration and platelets are leukocyte reduced by apheresis. Transfusion services at Saint Luke's hospitals consider leukocyte reduced products to be CMV safe and automatically substitute them for CMV negative orders in adult patients.

Irradiated Blood Components

Red blood cells and platelets can be irradiated to inactivate lymphocytes and prevent transfusion associated graft versus host disease (GVHD). Leukocyte reduction does not remove sufficient numbers of lymphocytes to prevent GVHD. Plasma and cryoprecipitate do not need to be irradiated.

Irradiation does not affect cell survival or function but does damage the red blood cell membrane sodium-potassium pump, causing leakage of potassium across the cell membrane into the plasma. Plasma potassium levels increase almost twofold within 24 hours. This potassium load is not harmful to most adults, but can significantly elevate potassium levels in neonates and fetuses. This

potential problem can be avoided by irradiating units just prior to transfusion.

Clinical indications for ordering irradiated blood include:

- Recipients of allogenic and autologous hematopoietic progenitor cell transplantation
- Children with severe congenital immune deficiency syndromes
- Granulocyte transfusions
- Recipients of transfusions from blood relatives
- Treatment with purine analogue drugs (fludarabine, cladribine, deoxycoformycin)
- Treatment with Campath (anti-CD52)
- Treatment with anti-thymocyte globulin
- HLA matched or partially matched platelet transfusions
- Hodgkin's Disease
- Acute leukemia if patient is a transplant candidate
- Non-Hodgkin lymphoma if patient is a transplant candidate
- Intrauterine (fetal) transfusions
- Neonates who received irradiated components as fetuses
- Neonatal exchange transfusions

Administration of irradiated products is the same as the administration of non-irradiated products.

Benefits of Blood Management

A recent study from The Center for Bloodless Medicine and Surgery at Johns Hopkins Hospital demonstrated that patients who declined transfusions and were managed by blood conservation suffered fewer deaths, infections and other morbidities compared to patients who were transfused (Clinical Anesthesiology, November 2014, volume 40:11).

The study included 294 patients who refused blood transfusion and 1157 patients with closely matched backgrounds that received transfusion during either surgical or medical care between June 2012 and August 2013. Medical patients included patients with cancer and gastrointestinal bleeding. Discharge hemoglobin levels averaged 10.8 for both groups of patients.

Blood conservation methods included the diagnosis and treatment of anemia before hospitalization, inpatient treatment with IV iron and erythropoietin, reduction of intraoperative blood loss, and autologous blood salvage during surgery.

Mortality rates were 2.7% for patients receiving transfusion and 0.7% in patients managed with blood conservation methods. Rates of infection and thrombosis also trended lower in non-transfused patients.

Total and direct hospital costs were 12% and 18% lower, respectively, in the non-transfused group. Savings were most pronounced in surgical patients. The average total charge for bloodless patients was $25,568 compared to $30,162 for transfused patients. Hospital lengths of stay were roughly the same for the bloodless patients and those in the control group.

Although the number of patients undergoing bloodless therapy was small, this controlled study clearly demonstrated the medical and financial benefits of a comprehensive blood management program.

Stool Microbiology on Inpatients

Results from the first 100 Gastrointestinal Pathogen Panel PCR tests performed by Saint Luke's Microbiology yielded 32 pathogens. Nineteen of those pathogens would not have been detected by conventional testing. Effective January 21, the Gastrointestinal Pathogen Panel PCR will be performed on SLHS metro hospital inpatients, instead of stool cultures or ova/parasite exams.

Specimen Collection Changes

The introduction of new blood gas analyzers at the metro hospitals has necessitated a change in specimen collection for ionized calcium and carboxyhemoglobin. Previously, SLHS laboratories were able to measure ionized calcium in blood collected in either red top or green top tubes. Now, the only acceptable specimen is a green top (lithium heparin) tube.

Previously, carboxyhemoglobin could be measured on blood collected in either lavender top (EDTA) or green top (lithium heparin) tubes. Now the only acceptable specimen is a green top tube.