Universal Irradiation of Cellular Blood Products (RBC and Platelets)

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Cellular blood products are irradiated to prevent Transfusion Associated Graft Versus Host Disease (TA-GVHD), a usually fatal condition. This disease occurs when donor lymphocytes engraft in a susceptible recipient, proliferate and damage target organs. Irradiation cross links the thymidines of the DNA and when the irradiated cell attempts to divide, it dies.

At this time the Transfusion Services Laboratory (TSL) irradiates blood for potentially at risk patients: infants < 1 year old, potential and actual bone marrow transplant patients, chemotherapy patients, patients identified as immunodeficient or immunosuppressed and blood to be given to patients from a directed donor who is a first degree relative, HLA matched platelets and cross-matched platelets. The TSL irradiates 55-65% of the cellular blood products (RBC and platelets). While there have been no identified negative consequences related to failure to irradiate a product which should have been irradiated, each year we identify 2-3 incidents where we fail to irradiate blood which we knew needed irradiation. In addition there are undoubtedly incidents of failure to irradiate which are not identified. Examples of concerns would be undiagnosed patients with any of the above conditions or directed donor blood not properly identified as being from a first degree relative or from a non-first degree relative but from a population where consanguinity would not be uncommon.

Based on these concerns the Transfusion Committee proposed universal irradiation of all cellular blood products. In the past this would be an uncommon proposal but it is becoming more common. Boston Children’s Hospital, Children’s Hospital of Philadelphia, and St Jude’s Hospital have instituted universal irradiation in the past few years and Children’s Hospital Los Angeles instituted this policy in June 2007. At CHOP they do not irradiate all blood for cardiac surgery because they irradiate blood days ahead of time and there is a concern for hyperkalemia (see below).

There are two risks associated with RBC irradiation: (1) potential hyperkalemia and (2) earlier outdating of RBC. Both these down-sides only exist if RBC are irradiated ahead of time and then held for an extended period of time (days). It has been the practice of CMH, and will continue to be the practice, to only irradiate blood just before it is issued. This eliminates the above concerns. This does mean that emergency uncrossed matched blood may not be irradiated. Other blood units which are required in a time frame which does not permit the 7-10 minutes needed for irradiation may also not be irradiated. There is no identified risk of irradiation of platelets. The remaining concerns are logistics and cost.

The Transfusion Committee has endorsed this proposal in the belief that the elimination of the risk of missing a patient who requires irradiated blood is more then worth the extra effort and costs needed to irradiate all blood. The staff in the TSL are pleased with the prospect of having a single procedure which eliminates a source of error associated with selective irradiation.
Currently the charge for irradiation is $83. The current proposal is to accept some loss of revenue and then to spread charges over all products. The patient charge for a unit of RBC is $425 and for a platelet pheresis is $904. The cost of these products will increase ~ $25 or 2-5%.

The Medical Staff Executive Committee approved this proposal and the Transfusion Services Laboratory implemented universal irradiation on November 15th. It is no longer necessary to order irradiated blood.

Frequently leukoreduction and irradiation are confused. Leukoreduction refers to the process of filtering blood or platelets to remove most, but not all leukocytes. At CMH all cellular blood products are leukoreduced. This renders the blood “CMV safe” since the CMV virus is in the leukocytes and we limit the use of CMV negative blood to highly selected, severely immunocompromised patients such as patients with Severe Combined Immunodeficiency. Leukoreduction also minimizes exposure to the HLA antigens associated with leukocytes and helps prevent platelet refractoriness associated with antibodies to HLA antigens. Leukoreduction also helps to minimize febrile, non-hemolytic transfusion reactions which are associated with cytokines release by leukocytes during blood storage. Finally leukoreduction minimizes immunomodulation associated with transfusion. This is a controversial concept but evidence is mounting that transfusion alters the immune response and leaves the patient less responsive to pathogens i.e. bacteria and viruses. The simplified version of this concept is that the patient is responding to the antigens associated with the transfusion and, as a result, has limited capacity to respond to other antigens.

Irradiation is discussed above. It is important to understand that these processes are not interchangeable.