



Karolinska Institutet

Institutionen för Laboratoriemedicin

New approaches to preparation and storage of platelets

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ABSTRACT

During the last century, transfusion of blood components has become a prerequisite for treatment in many clinical settings. The availability of plastic bags and methods for centrifugation and separation of blood cells, has enabled processing of whole blood into blood cell components, and made it possible to optimize transfusion therapy, as well as storage conditions. Automation of the processes has been introduced, which increases reproducibility and standardization of the prepared components.

Recommendations of leukocyte reduction to minimize side-effects caused by concomitant leukocytes have resulted in development in different types of filters. Today, universal leukocyte reduction is practice in many countries and in Sweden, a majority of the blood components are leukocyte reduced.

For the immunosuppressed patients, who are at risk of developing transfusion associated graft-versus host disease attributed to passenger T-lymphocytes, there is need for further treatment of the blood components to restrain the proliferation of T-lymphocytes, and hence prevent TA-GVHD. The prevalent method has been gamma irradiation, and in recent years X-ray irradiation has been available as another alternative to gamma irradiation from radioactive sources.

The studies included in the present thesis focus on 1) preparation techniques for leukocyte reduction of whole blood which saves platelet, and results in preparation of erythrocytes, plasma and platelets, 2) automated preparation of leukocyte reduced platelets from pooled buffy coats and standardization of platelet content by selection of buffy coats, 3) evaluation of platelet additive solutions with different composition, with the aim to optimize storage conditions and 4) effects of gamma- and X-ray irradiation on platelets during storage.

The results indicate that leukocyte reduction of whole blood with a filter that saves platelets results in blood components with sufficiently low leukocytes, satisfactory recovery of erythrocytes and platelets, and high quality as measured by in vitro parameters, which were maintained during storage.

Automated preparation with OrbiSac of leukocyte reduced platelets from pooled buffy coats and standardization of platelet content by selection of buffy coats was introduced. Prepared platelets displayed in vitro characteristics during storage for 7 days, equivalent to the previous manual method. Moreover, the platelet count variation was reduced.

Evaluation of different platelet additive solutions concluded that addition of phosphate is beneficial for storage of platelets. This finding has had an impact on development of the next generations of platelet additive solutions.

Effects of different irradiation equipments were studied. No major deleterious effects of gamma irradiation on platelets during storage were identified. For X-ray irradiation previous data are scarce especially for platelets and our results imply that X-ray irradiation does not compromise the quality of platelets during storage for 7 days.

The studies all represent new options for blood component preparation, which has enhanced efficacy and safety.