FUTURE DEVELOPMENTS IN BLOOD BANKING
DEVELOPMENTS IN HEMATOLOGY AND IMMUNOLOGY

Future Developments in Blood Banking

Proceedings of the Tenth Annual Symposium on Blood Transfusion, Groningen 1985, organized by the Red Cross Blood Bank Groningen-Drenthe

edited by

C.Th. SMIT SIBINGA and P.C. DAS

Red Cross Blood Bank Groningen-Drenthe
The Netherlands

T.J. GREENWALT

Paul I. Hoxworth Blood Center, Cincinnati, Ohio, U.S.A.
Acknowledgement

This publication has been made possible through the support of Travenol, which is gratefully acknowledged.
CONTENTS

Moderators & Speakers ........................................... IX
Foreword .......................................................... XI

I. Community aspects

Changing demographic aspects
(H.A.W. van Vianen) ............................................. 1

Changing emphasis in collection procedures
(C.F. Högman) .................................................. 9

HTLV III/LAV: The role of molecular biology in viral detection and prevention
(B.A. Jameson) ................................................ 17

Legal aspects of blood banking: An American perspective
(S.L. Lentz) ..................................................... 27

Discussion ....................................................... 41

II. Production aspects

Perspective of the future in developing countries
(F.A. Ala) ....................................................... 45

Bag designs, plastics and preservatives
(J.M. Anthony) .................................................. 61

In vivo kinetics in autologous transfusion of red cells preserved 42 and 49 days at +4°C in PAGGSS and in ADSOL-AS1
(L. Noel) ........................................................ 67

Platelet function during storage in PVC bags with increased gas permeability
(K. Koerner) .................................................... 75

Developments in apheresis technology
(D.W. Huestis) .................................................. 83

Manufacturing in the Blood Bank of high purity heat-treated factor VIII concentrate from heparin stabilized blood and its consequences for the red cells and supernate plasma components
(K. Wallevik) .................................................... 95

Heating of double coldprecipitated factor VIII concentrate from heparinized plasma
(P.C. Das) ....................................................... 103
VIII

Practical aspects of ice-free cryopreservation
(G.M. Fahy) .................................................... 111

Properties of hemoglobin interdimerically cross-linked with NFPLP
(J.C. Bakker) ................................................... 123

Production of Hematopoietic cells in Culture (E.D. Zanjani) ......... 131

Discussion ...................................................... 147

III. Laboratory aspects

Machine-readable symbols in blood transfusion
(H.K. Prins) .................................................... 151

Safety and control in bar-code symbology within the blood
transfusion service
(P.S. Skinner) ................................................... 155

Application of robotics in blood banking
(L.I. Friedman) ................................................. 157

Monoclonal antibodies as tools for the Immunohematologist
(A.E.G. Kr. von dem Borne) ..................................... 167

Solid phase red cell adherence tests in the Blood Banking
(F.V. Plapp) ................................................... 177

A preliminary report on the evaluation of the Kontron
MicroGroupamatic
(J.M. Sangster) ................................................ 207

CMV antibody testing in blood donors
(R.L. McShine) ................................................. 213

Standards and quality assurance
(R.E. Klein) .................................................... 215

Discussion ...................................................... 219

IV. Clinical aspects

Recent changes in patient population: A mission for Blood Banks
(C. Goffe) ...................................................... 227

Perspectives in supportive hemotherapy
(C.Th. Smit Sibinga) ............................................ 241

Liver transplantation with CMV negative blood and its products
(A. Maas) ...................................................... 249

Factors and mechanisms involved in renal allograft rejection in man
(J.D.L. Schot) .................................................. 255

Bedside practice of blood transfusion to be developed?
(K. Mayer) ..................................................... 269

Discussion ...................................................... 275
MODERATORS AND SPEAKERS

Moderators

T.J. Greenwalt
C.Th. Smit
Sibinga
C.F. Hagman
P.C. Das
H.F. Polesky
R.L. McShine
M.R. Halie

Speakers

F.A. Ala
J.M. Anthony
J.C. Bakker
A.E.G. Kr. von dem Borne
C. Coffe
P.C. Das
G.M. Fahy
L.I. Friedman
T.J. Greenwalt
C.F. Högman
D.W. Huestis
B.A. Jameson

- Paul I. Hoxworth Blood Center, Cincinnati OH, USA
- Red Cross Blood Bank Groningen-Drenthe, Groningen, NL
- The Blood Centre University Hospital, Uppsala, S
- Red Cross Blood Bank Groningen-Drenthe, Groningen, NL
- The War Memorial Blood Bank, Minneapolis, MN, USA
- Red Cross Blood Bank Groningen-Drenthe, Groningen, NL
- Division of Hematology, University Hospital Groningen, Groningen, NL
- Regional Blood Transfusion Centre, Birmingham, UK
- Travenol Laboratories, Deerfield, IL, USA
- Central Laboratory of the Dutch Red Cross, Amsterdam, NL
- Central Laboratory of the Dutch Red Cross, Amsterdam, NL
- Regional Blood Transfusion Service, Besançon, F
- Red Cross Blood Bank Groningen-Drenthe, Groningen, NL
- American Red Cross, Blood Services Laboratories, Bethesda, MD, USA
- American Red Cross, Blood Services Laboratories, Bethesda, MD, USA
- Paul I. Hoxworth Blood Center, Cincinnati OH, USA
- The Blood Centre University Hospital, Uppsala, S
- The University of Arizona, Tucson, AZ, USA
- Max von Pettenkofer-Institut, München, FRG
R.E. Klein – American Red Cross Blood Services, Winston Salem, NC, USA
K. Koerner – Blood Transfusion Services Baden-Würtemberg, Ulm, FRG
L.C. Lasky – Veterans Administration Medical Center, Minneapolis, MN, USA
S.L. Lentz – Minneapolis, MN, USA
A. Maas – Red Cross Blood Bank Groningen-Drenthe, Groningen, NL
K. Mayer – Sloan-Kettering Cancer Center, New York, NY, USA
R.L. McShine – Red Cross Blood Bank Groningen-Drenthe, Groningen, NL
L. Noel – Regional Blood Transfusion Service, Versailles, F
F.V. Plapp – Community Blood Center of Greater Kansas City, Kansas City, MI, USA
H.K. Prins – Central Laboratory of the Dutch Red Cross, Amsterdam, NL
J.M. Sangster – London, UK
R.K.B. Schuurman – Eurotransplant, Leiden, NL
P.S. Skinner – Ulrich Schnoor GmbH, Neumünster, FRG
C.Th. Smit Sibinga – Red Cross Blood Bank Groningen-Drenthe, Groningen, NL
H.A.W. van Vianen – Geographical Institute University of Groningen, Groningen, NL
K. Wallevik – Blood Bank and Blood Grouping Laboratory, Århus, DK
Encapsulation of hemoglobin in liposomes making longer sojourn in the circulation possible seems more attractive because it also reduces the likelihood of renal damage. There has also been much discussion of using perfluorocarbons for O₂ and CO₂ transport. I do not believe that they will ever replace donor blood. But suitable analogues and improved emulsifiers which will make it possible to store perfluorocarbon emulsions at room temperature, will make these products useful for getting oxygen to tissue crevices inaccessible to erythrocytes. Very much further in the future I can envision a form of blood banking gardening. There is hope that it will be possible to isolate dedicated precursors of red cells, leukocytes and even platelets from the bone marrow and in some instances from the peripheral blood and to grow them in culture by methods that will make it possible to harvest the desired formed elements. I will let your imagination run with that idea.

The control of disease transmission by blood products must be given high priority in the future. It is likely that a practical method for detecting the antigens of the HTLV-III virions will be developed within the next 5 years. There is much work already underway to achieve this as well as the development of a vaccine. In the future we should be able to convince the funding agencies to give the problem of non-A non-B hepatitis a higher priority. I feel confident that within the next 5 years specific tests of the non-A non-B virus group will become available. The development of a vaccine should follow. The cytomegalovirus problem will draw more and more attention as we increase the number of organ (including bone marrow) transplantations and in the increasing use of blood products for managing premature infants. The present methods of screening donors are not completely satisfactory. It will become possible for us to pinpoint more accurately those donors whose blood actually contains the virus. A test for IgM anti-CMV antibodies will prove to be more useful for identifying the much smaller percentage of donors who should not be used for transfusing immunocompromised patients. Production of factor VIII and factor IX concentrates by DNA recombinant techniques will eliminate the remaining hazard of transmitting viral hepatitis with the presently available heated products. There have been some difficulties in producing the factor VIII material, but I am reasonably certain the product will become available within 3 to 5 years. Unfortunately the market is so limited for factor IX that development of this product by recombinant methodology will probably not occur unless it is subsidized.

I believe that we have not come to the end of the list of viruses and prions which can be transmitted by blood products. New problems are bound to occur in the future e.g., HTLV-I, multiple sclerosis, Alzheimer’s disease. In the meantime if we solve the problems associated with AIDS and hepatitis it is most likely that our surgical colleagues will relax their concern about the use of blood and will cause new problems of supply.

We are already in the midst of changes in laboratory procedures. Monoclonal reagents will replace all the antibodies which are now used for processing donor blood, crossmatching and essentially all serological procedures. Solid phase methods will replace our presently used techniques. The large automated machines we now use for performing the serological tests for processing blood will be replaced by microtiter solid phase techniques.
with automated reading and positive sample identification. The signals will be fed directly into the computerized laboratory stream. Computers will co-ordinate all the steps used in donor history taking, laboratory testing, labelling, issuance of blood products, inventory control and ultimately will be used in closing the now open loop of identity between the crossmatched unit and the patient designated to receive it. The massive amounts of paperwork which are now involved will largely be eliminated.

The serious problem of graft versus host disease in bone marrow transplantation will be eliminated by obtaining better matching between the organ donor and the recipient using selected DNA probes. T-cell depletion techniques will be simplified. Within the next 10 years non-related marrow donors will be used fairly frequently and international computer-linked files will be developed. Techniques will be found for increasing the yield of pluripotent cells from the peripheral blood of selected donors. This may make possible the reconstitution of patients using frozen stored pluripotent cells harvested by selective apheresis. Thus marrow transplantation will not have to be restricted to the 25 to 30% of patients who happen to be fortunate enough to have a matching living related donor. Successful management of many malignancies will be made possible by the use of autologous bone marrow transplants. The present worry about reimplanting contaminating tumor cells will be eliminated by the use of specific monoclonal antibodies tagged with ricin and other cell toxins targeted to destroy the undesirable residual tumor cells while sparing the needed pluripotent precursors.

The range of hemapheresis products useful for the management of patients will be increased and improved. Essentially pure concentrates of single donor platelets without any contaminating leukocytes and pure concentrates of lymphocytes and subsets of lymphocytes will become available for use as indicated. Hollow fiber and membrane techniques will make rapid plasmapheresis for obtaining plasma for fractionation and other purposes simple and routine. Patients not qualified to give whole blood will be selectively used as plasma donors. Clarification of the indications for therapeutic hemapheresis will gradually evolve. Membrane cascade filtration systems will replace more cumbersome methods for removing lipids, biologic and exogenous toxic materials making it possible to return to the patient not only the formed elements but also the purified plasma. Thus the need for using plasma derivatives and other solutions will be eliminated. Specific columns will be used for selectively removing undesirable plasma components. Examples of such systems include activated charcoal, Staphylococcus protein A and monoclonal antibody columns.

Further education of physicians in transfusion medicine is absolutely essential. Within the next 5 to 10 years present efforts to introduce more opportunities for instruction in transfusion medicine will be introduced into the curricula of medical schools, training programs for house staff and the continuing education of physicians. Excellent computer assisted instruction programs for these purposes will be developed. They will be so flexible and adaptable that they should have international utility. Transfusion medicine will continue to receive recognition from the professions and the public. Specialists in transfusion medicine will regularly be used as consultants.
Funding agencies will ultimately recognize the importance of research and development in transfusion medicine and the proportion of research money earmarked for such purposes will be increased.

I suggest that 15 years from now, on the occasion of the silver anniversary Groningen symposium, the predictions of Nostradamus be reviewed to test their accuracy using the retrospectroscope.

T.J. Greenwalt, MD
Chairman