Changes in transfusion science over the past 25 years

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Thanks to advances and modifications to transfusion policies and practices over the past 25 years, Aotearoa New Zealand now justifiably enjoys the reputation of being one of the best places in the world to receive a safe, effective, and timely blood transfusion.

This is due in no small part to the formation of a national blood transfusion service in 1998. Prior to 1998, each part of the country was served by its own regional blood service. Differences in testing policies existed between regions and there was no national computerised database in which to hold a patient's transfusion records prior to 1998. The "vein to vein" philosophy of New Zealand Blood Service (NZBS) sees the service take responsibility for a nationally standardised approach to the collection, testing and provision of all blood components and products transfused in New Zealand (1).

The creation of a national blood management system now ensures a patient's records can be accessed from anywhere in the country. This enhances transfusion safety for the patient; by establishing the history of a patient's blood group, pre-analytical errors such as wrong blood in tube can be detected. If a patient has a historical antibody that has currently fallen to undetectable levels, the presence of that antibody is recorded on the national database and the patient issued with appropriate safe blood, wherever they reside. In the past one would not have known this history unless the patient remained in a region served by one regional transfusion service throughout their life. When transfusion errors do occur, they are recorded and collated nationally and reported in the haemovigilance report published annually by NZBS. This national monitoring further enhances transfusion safety for patients through modification of practice.

Studies which track the risk of catching an infection from a blood transfusion reveal how much safer blood transfusions are from this standpoint. For example, in 1985 the risk of catching Human Immunodeficiency Virus (HIV) from a blood donation was approximately 1 in 100 (2), now it is less than one in a million (3). In 2001, the introduction of viral genome detection through the amplification technology known as Nucleic Acid Testing (NAT) resulted in a decrease in the time taken to detect blood donors infected with HIV and Hepatitis C virus (4). Later, Hepatitis B virus was added to the NAT regime, and transfusion-transmitted hepatitis is now a very unusual occurrence in New Zealand (3,5). Technological improvements in the testing of transfusion-transmitted infections are continuous and state of the art. As well as screening for well-established transfusion transmitted pathogens, the NZBS also monitors emerging agents, and when a new test is introduced, the whole of New Zealand benefits from the introduction of the screening test at the same time. It seems incredible now to think that different regions of New Zealand began their HIV and hepatitis screening at different times.

NZBS also introduced universal leucodepletion (removal of white blood cells from all blood components) early in the 21st century. Whilst this was driven largely by variant Creutzfeldt Jakob Disease fears in the last two decades of the 20th century, it brought a host of other safety advantages to blood components, including reduction of human leucocyte antigen (HLA) allo-immunisations, and consequent investigations of febrile reactions in transfused patients. The latter were time consuming for blood banks to conduct and as the workload of blood banks has steadily increased, and a febrile reaction is considered clinically insignificant, any drop in the number of transfusion reaction investigations of this type is helpful.

The international attitude to blood transfusion has changed and our country is no exception. The campaign conducted by NZBS in New Zealand hospitals carries the slogan "why give two when one will do?", exhorting clinicians to transfuse fewer red cells. This acknowledges that patients can have good quality of life with a lower haemoglobin level than previously believed, and that blood carries inherent risks, which increase with each unit transfused. This is a far cry from the belief held in blood banks during my training, when we were told if the patient needed only one unit, it was not really necessary to transfuse them at all! Before the formation of NZBS, many donations were discarded because they reached the end of their shelf life without being transfused. This wastage of our precious resource of blood donations has now been minimised, with red cells being re-directed before expiry to any area of the country.

Plasma is currently a major driver in the recruitment of blood donors. With the development of fractionated plasma products such as intravenous immunoglobulin being used to treat an ever-growing number of medical conditions, very large volumes of plasma are needed in New Zealand. Consequently, plasmapheresis is now a very common way to donate.

Technologies of column agglutination testing and solid phase red cell adherence to screen patients for unexpected blood group antibodies have made automation possible in a way that the old tube testing simply did not lend itself to. When automation first started making inroads into medical laboratory testing, I worried that this would make our job as transfusion scientists less interesting. On the contrary, the way the blood bank analysers are utilised means that the routine samples are taken care of on the analyser, leaving the scientist free to use their hands and brains on the more challenging samples from patients requiring identification of rare or multiple antibodies, investigation of haemolytic disease of the fetus and newborn, or investigation of autoimmune haemolytic anaemia.

Tissue typing is the arm of the blood service which matches donors with patients for solid organ and haemopoietic transplantation. In the past the tissue typing laboratory mainly used serological testing, with some manual molecular testing. As in many areas of the diagnostic laboratory, automated molecular testing is now the "go to" methodology. The polymorphism of Human Leucocyte Antigen (HLA) types seems to be almost unlimited, and to deal with this, companies manufacturing the testing kits are required to continually update their consumables and software.

The shelf life of platelets has been extended, thanks to bacterial detection testing and resuspension in platelet additive solution (PAS). Once again, the existence of a national service meant that the whole of New Zealand moved to the new component with its new shelf life at the same time. For this reason, New Zealand is frequently the envy of international blood banks who may or may not receive platelets in PAS, depending on who their supplier is. This must be challenging for clinicians in these countries, who undoubtedly want to treat all their patients with equal-quality blood components.

The introduction in 2008 of the Massive Transfusion Protocol caters for patients experiencing massive blood loss through a protocol which sees boxes of components delivered in a balanced ratio designed to maintain haemostasis (6). This has replaced the ad-hoc call for varying numbers of red cells, fresh frozen plasma, platelets, and cryoprecipitate. Whilst patients still need to be monitored for coagulopathy, the introduction of this regime has undoubtedly saved lives, and smoothed communication channels between the emergency room and the blood bank. Similarly, the introduction of prophylactic antigen matched (PAM) red cells (7) for patients who are transfusion dependent over long time periods has resulted in less alloimmunisation (8), and therefore less difficulty in sourcing compatible blood for people with multiple antibodies.

These many changes over the past 25 years mean that New Zealand can be proud to be a world leader in Transfusion in 2021. Most recently, New Zealand has engaged in research-led practice to provide convalescent plasma for patients seriously ill with COVID-19 (9). Whilst at the time of writing we have thankfully not had the need for this to become a routine treatment in New Zealand, it is an example of the proactive approach taken by our transfusion professionals. I have every confidence that our country will continue to evolve in the important field of transfusion medicine over the next 25 years and into the future beyond.

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