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EXPERIENCES WITH FROZEN BLOOD PRODUCTS IN THE NETHERLANDS MILITARY

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Background: For peacekeeping and peace enforcing missions abroad the Netherlands Armed Forces use deep frozen blood products. Deep frozen (-80°C) erythrocytes (DEC) can be stored for 10 years, deep frozen plasma (DFP) for 7 years and deep frozen thrombocytes (DTC) for 2 years.
Aim: This study was initiated to validate the quality of the frozen and thawed products both in the Netherlands and in theatre. The experiences of the Netherlands military with these frozen blood products are described, with special attention to quality control and compliance with (inter)national regulations and guidelines.
Methods: Leukodepleted whole blood units (O Rh (D) pos and neg, n=1360) were concentrated (Ht 0.82±0.04), glycerolized, using the automated cell processor ACP215, concentrated again (Ht 0.60 ±0.03) and frozen to '80 C. After thawing, the units (n=147) were deglycerolized both in the Netherlands and in Iraq, using the ACP215, and stored for 2 weeks at 4°C in AS3. Leukodepleted Fresh Frozen Plasma units (-30°C, AB Rh (D) pos and neg, n=12) were thawed after release from quarantine, repacked and frozen to '80 C. Prior to and after '80 C freezing, the concentration of factors V and VIII was determined. DMSO was added to leukodepleted, plateletpheresis units (O Rh (D) pos and neg, n=217) to a final concentration of around 5%. The platelets were concentrated to a volume of 14±4ml and frozen to '80 C. After thawing, the platelets were suspended in thawed DFP (n=27) and platelet count and pH were determined.
Results: Approximately 3 g of hemoglobin was lost during the glycerolization process and 60±5 g of hemoglobin was frozen in 40±0.5 g/dL glycerol. After thawing and deglycerolization the product yield was 45±3 g with a glycerol concentration of 0.18±0.03 g/dL. Hemolysis during 2 week storage in AS3 remained below 1% (0.6±0.2%). Compared to FFP, plasma factors V and VIII were reduced slightly in DFP, but well above 0.7 U/ml. Fresh (<24 hrs) platelets (381±68 x 109 platelets/ unit) were treated with 27% DMSO, 349±58 x 109 platelets/unit were frozen in 5.1±0.4% DMSO. After thawing the DTC and suspension in thawed DFP 269±45 x 109 platelets/unit were recovered in the AB plasma, containing 0.7±0.2 gram of DMSO, pH 7.7±0.1. No differences were observed between the quality of DEC and DTC units thawed in the Netherlands and in theatre. The quality of our frozen and thawed blood products is in compliance with the European and US guidelines for standard red cell concentrates, plasma and platelets.
Conclusions: Frozen blood products can easily, effectively and safely be used in deployed blood bank units, reducing waste, due to expiration, to the absolute minimum. Deployed military hospitals become independent of a 'walking blood bank' and the logistic burden can be reduced since less shipments are required to resupply the in theatre inventory. A frozen blood bank facility with a stock of frozen universal donor products can thus effectively be used in remote areas, to compensate for periods when less or no donors are available, resupply is impaired and/or suddenly many patients are in need for blood products.