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The Evolving Application of DNA-Based Genotyping of Red Blood Cells in Blood Grouping: A Narrative Review

L'Application Évolutive du Génomage Basé sur L'adn des Globules Rouges dans le Groupage Sanguin: Une Revue Narrative

T. O. Akinyemi^{*†}, F. A. Fasola[‡], O. A. Olateru-Olagbegi[§]

ABSTRACT

Blood grouping system is made of diversities of inherited specific antigen markers located on the red cell membrane. Exposure to foreign antigens not present in individual genetic make-up stimulates the production of the corresponding alloantibodies which often times is detrimental to health. The high throughput, specific and cost-effective DNA-based red cell genotyping has improved health care delivery in blood transfusion science by enhancing our understanding of the genetic variations which control the expression of red cell antigens. It improves efficiency, accuracy of test, and enhances personalized therapy especially in transfusion dependent patients. This review aims to evaluate the evolving application of DNA-based red cell genotyping in determining blood group. It has helped to resolve discrepancies encountered with the conventional serological testing especially in difficult-to-type patients. Rare cell phenotypes with no commercially available antisera or weakly reacting antigens are easily detected. Furthermore, in-utero fetal DNA genotyping for identifying fetus at risk of haemolytic disease of fetus and newborn (HDFN), selection of donors for bone-marrow transplant and monitoring haemopoietic progenitor cells after ABO mismatch are other important applications of DNA-based genotyping. *WAJM 2021; 38(3): 269–273.*

Keywords: Red blood cells; blood grouping; DNA-based genotyping.

ABSTRAIT

Le système de groupage sanguin est composé de diversités héréditaires marqueurs antigéniques spécifiques situés sur la membrane des globules rouges. Exposition à des antigènes étrangers non présents dans la génétique individuelle le maquillage stimule la production de la les alloanticorps qui sont souvent préjudiciables à la santé. Le rouge à base d'ADN à haut débit, spécifique et économique le génotypage cellulaire a amélioré la prestation des soins de santé dans le sang la science transfusionnelle en améliorant notre compréhension de la variations génétiques qui contrôlent l'expression des globules rouges antigènes. Il améliore l'efficacité, la précision du test et améliore thérapie personnalisée en particulier chez les transfusionnels les patients. Cette revue vise à évaluer l'application évolutive du génotypage des globules rouges à base d'ADN dans la détermination du groupe sanguin. Il a permis de résoudre les écarts rencontrés avec le tests sérologiques conventionnels, en particulier dans les cas difficiles à taper les patients. Phénotypes de cellules rares sans les antisérums ou les antigènes faiblement réactifs sont facilement détectés. De plus, le génotypage de l'ADN fœtal in utero pour identifier fœtus à risque de maladie hémolytique du fœtus et du nouveau-né (HDFN), sélection de donneurs pour greffe de moelle osseuse et surveillance des cellules progénitrices hémo-poïétiques après mésappariement ABO sont d'autres applications importantes du génotypage basé sur l'ADN. *WAJM 2021; 38(3): 269–273.*

Mots clés: Globules rouges; groupage sanguin; À base d'AND génotypage

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Abbreviations: ABO, ABO Blood Group System; ASO, Allele Specific Oligonucleotide; cffDNA, Cell Free Fetal DNA; ctDNA, Circulating Tumor Deoxyribonucleic Acid; DNA, Deoxyribonucleic Acid; D^u, Weak D Antigen; HDFN, Haemolytic Disease of Fetus and Newborn; HPLC, High Performance Liquid Chromatography; IgM, Immunoglobulin M; MALDI-TOF/MS, Matrix-Assisted Laser Desorption Ionization Time-of-Flight Mass Spectrometry; MNS, MNS Blood Group System; mRNA, Messenger Ribonucleic Acid; NGS, Next Generation Sequencing; PCR, Polymerase Chain Reaction; RBC, Red Blood Cells; RFLP, Restriction Fragment Length Polymorphism; Rh, Rhesus; RHCE, Rhesus CE; RHD, Rhesus D; SCD, Sickle Cell Disease; SNP, Single Nucleotide Polymorphisms; T-NGS, Target-Next Generation Sequencing.