

Abstract 25

ECTmatch: Optimizing Small-Scale Cord Blood Banking Through HLA Analysis

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Introduction: Cord blood (CB) banks have had to rely on large inventories of CB units to try to serve the largest possible proportion of the population, all the while prioritizing collection of non-Caucasian ethnic groups. However, due to the high linkage disequilibrium of HLA genes and the high frequency of several HLA alleles in the population, CB banks contain hundreds of CB units that could be matched to the same patients, making the inventory somewhat redundant from a clinical standpoint.

Objective: ExCellThera developed ECTmatch, an algorithm dedicated to optimizing the selection of CB units based on in-depth HLA analysis in order to maximize the efficiency of the bank to suitably match the largest proportion of subjects within a small pool of donors.

Methods: The performance of ECTmatch was evaluated in a simulation aiming to select 100 CB units from the Héma-Québec CB bank that satisfied an arbitrary minimal cell content criteria of 120×10^7 TNC and 6×10^6 CD34+ cells ($n = 2,987$). Selection was performed to optimize matching for the Quebec population, with a minimal HLA-match of 5/8 for HLA-A, -B, -C, and -DRB1.

Results: ECTmatch provides a suitably matched donor for 71.5% of the Quebec population, compared with only 45.0% ($\pm 2.4\%$) with random selection. Because patients who require a CB transplant tend to have rarer HLAs, the performance of ECTmatch was evaluated for this specific subset of patients ($n = 62$). Again, ECTmatch outperformed random selection, by providing a donor for 54.8% of patients, compared with only 29.9% with random selection. Finally, while ECTmatch was developed to optimize CB selection specifically for the Quebec population, it still outperformed random selection for subjects from the other Canadian provinces or the USA.

Discussion: By selecting CB units based on HLA profiles, ECTmatch allows the creation of a highly useful inventory with a very low number of CB units. This approach to small-scale CB banking can be adapted to different population subsets and could be used to select a subset of CB units for pre-release for immediate clinical availability or for the creation of a pre-expanded CB inventory with maximal population coverage.