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Cytogenetics Worldwide

Introduction

With the advance of molecular technology in the past thirty years, cytogenetic analysis has become essential for making an appropriate diagnosis, prognosis, and treatment plan for children with acute leukemia. It is now a regular practice to document the frequencies of chromosomal translocations that are found in children with acute myeloid leukemia (AML) and acute lymphoblastic leukemia (ALL), but a comparison of the different frequencies of chromosomal translocations throughout the world has not yet been undertaken. Differing frequencies of chromosomal translocations in pediatric leukemia in populations worldwide could have large implications for the study of genetics and pediatric leukemia.

Objectives

- Perform a literature search of all journal articles in English related to pediatric ALL, AML, and cytogenetic analysis
- Abstract information regarding frequencies of common chromosomal translocations from different regions of the world
- Analyze the results for significant differences

Some Common Translocations in AML and ALL

Leukemia	Translocation	Genes
ALL	t(1;19)(q23;p13)	E2A-PBXl
ALL	t(9;22)(q34;q11)	BCR-ABL
ALL	t(4;11)(q21;q23)	MLL-AF4
ALL	t(12;21)(p13;q22)	ETV6-RUNX1/ TEL/AML1
AML	t(8;21)(q22;q22)	CBFA2(AML1)-ETO
AML	inv(16)(p13;q22)	CBFB-MYHll
AML	t(15;17)(q22;q12-21)	PML-RARA
AML	t(11;17)(q23;q21)	PLZF-RARA
AML	t(6;9) (p23;q34)	DEK-CAN
AML	t(1;22)(p13;q13)	RBM15-MLKl(OTT-MAL)

Methods

Collect → Abstract → Analyze → Report

- Searched PubMed for abstracts of articles containing information on frequencies of chromosomal translocations in clinic-based studies of pediatric AML or ALL
- Used a systematic approach with search terms to ensure thoroughness of search
- Excluded articles with a sample size of less than 10, relapsed patients, or patients with germ line abnormalities
- Search terms: pediatric, paediatric, childhood, infant, leukemia, leukaemia, acute leukemia, acute leukaemia, acute myeloid leukemia, acute lymphoblastic leukemia, cytogenetic*, translocation, chromosom*, karyotype, and experience
- Initial search yielded 3,703 articles; 277 were kept for abstraction
- Abstracted information on number of patients, type of leukemia, age at diagnosis, ethnicity, cytogenetic methods, and frequencies of translocations
- Will perform an analysis across the differing regions of the world

Results

- Articles were sorted based on the ethnic background of the children which included: North American (of African, South American, or European descent), European, African, Middle Eastern, East Asian, South Asian, and Australian
- Results will be analyzed via Chi-square tests and contingency tables.

Future Directions

Significant differences between the frequencies of specific chromosomal translocations worldwide will provide a reason to further investigate the following hypotheses:

- Particular genes involved in a translocation have a specific structure in certain areas of the world which makes breakage and translocation more likely
- Varying occurrences of chromosomal translocations around the world may suggest an environmental cause that is specific to that area
- Differing chromosomal translocation frequencies could be a result of permissive background genomes that cause more translocations

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