Paediatric Acute Lymphoblastic Leukaemia: A Narrative Review of Current Knowledge and Advancements

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Abstract:

Purpose: This review aims to provide an update on current knowledge regarding paediatric acute lymphoblastic leukaemia (ALL), focusing on advancements in diagnosis and treatment, as well as future directions in the field.

Recent findings: ALL is the most frequently diagnosed paediatric malignancy. The heterogeneity of childhood ALL requires a precise diagnostic algorithm incorporating morphological, immunophenotypic, and cytogenetic analyses. Research is exploring diagnostic approaches using next-generation sequencing and artificial intelligence-aided techniques. The pathophysiology of ALL involves genetic alterations which disrupt cell-cycle regulation, resulting in uncontrolled lymphoblast proliferation. Environmental factors also contribute to leukaemogenesis. Risk stratification using genetic subtypes has significant implications for therapy. Systemic and prophylactic intrathecal chemotherapy are considered essential. For high-risk, refractory, or relapsed ALL, haematopoietic stem cell transplantation and novel therapies including tyrosine kinase inhibitors, chimeric antigen receptor T-cell therapy, and blinatumomab immunotherapy, have improved outcomes. Ongoing clinical trials aim to improve treatment efficacy, reduce toxicity, and increase survival. Although prevention strategies for ALL exist at three levels, evidence remains limited.

Summary: Continued research and clinical trials are essential to addressing the gaps in treatment efficacy. Efforts to improve healthcare access and integrate novel diagnostic and therapeutic approaches are crucial for advancing outcomes of paediatric ALL patients.

Keywords:

Paediatric acute lymphoblastic leukaemia Diagnosis Chemotherapy CAR-T cell therapy Immunotherapy