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abstract

Revolutionizing Pediatric ALCL (Anaplastic Large Cell Lymphoma) Treatment: Targeting the ALK Pathway with Precision Therapy

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Revolutionizing Pediatric ALCL (Anaplastic Large Cell Lymphoma) Treatment: Targeting the ALK Pathway with Precision Therapy

Authors: *Faaizah Ahmed, Fathimatul Henna*

Affiliation: *Dubai Medical University*

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Introduction: Anaplastic large cell lymphoma (ALCL) is a rare and aggressive hematologic malignancy that primarily affects children and young adults. The ALK-positive subtype of ALCL, driven by genetic rearrangements in the Anaplastic Lymphoma Kinase (ALK) gene, represents a distinct clinical entity with a poor prognosis when treated with conventional therapies. Standard treatments, such as chemotherapy, often result in significant toxicity and long-term side effects, especially in pediatric patients.

The emergence of ALK inhibitors, particularly crizotinib and ceritinib, has opened new therapeutic avenues, targeting the ALK-driven oncogenic pathway with the potential for more effective, less toxic treatment strategies. However, the application of ALK inhibitors in pediatric ALCL is still in the early stages, and more research is needed to evaluate their safety and efficacy.

This review aims to explore the potential of ALK inhibitors in the treatment of pediatric ALCL, with a focus on their mechanisms of action, clinical outcomes, and future directions. The primary objective is to assess the efficacy of targeted ALK therapy in improving treatment outcomes and reducing systemic toxicity in pediatric patients. Secondary objectives include evaluating ongoing clinical trials and identifying genetic biomarkers that could predict responses to ALK inhibitors.

Methodology: A comprehensive review of the literature was conducted, focusing on clinical trials, case reports, and preclinical studies related to the use of ALK inhibitors in pediatric ALK-positive ALCL.

Key databases, including PubMed, Google Scholar, and ClinicalTrials.gov, were searched for studies published between 2010 and 2023. The review also considered molecular mechanisms, treatment protocols, and long-term survival data.

Results: The studies reviewed demonstrated that crizotinib and ceritinib, ALK inhibitors commonly used in adult ALCL, have shown promising results in pediatric patients with ALK-positive ALCL. Early clinical trials indicated significant tumor regression with reduced side effects compared to traditional chemotherapy. Notably, crizotinib has demonstrated efficacy in pediatric cases, with several studies reporting improved progression-free survival and a favorable toxicity profile. Genetic profiling also revealed specific ALK gene rearrangements as reliable markers for predicting therapeutic responses.

Conclusion: ALK inhibitors, particularly crizotinib, have emerged as a promising targeted therapy for pediatric ALCL. Their ability to selectively target the ALK pathway has resulted in better clinical outcomes with fewer long-term side effects compared to conventional chemotherapy. However, challenges remain in terms of drug resistance, optimal dosing, and long-term safety in children. Further research is required to refine treatment regimens, explore combination therapies, and identify biomarkers that can guide clinical decisions.

Targeting the ALK pathway with ALK inhibitors presents a transformative approach to treating pediatric ALK-positive ALCL. The promising results from early clinical trials indicate that crizotinib and ceritinib may provide significant benefits, including improved survival and reduced toxicity. Ongoing research will be essential to confirm these findings, optimize treatment strategies, and ultimately improve outcomes for pediatric patients with this aggressive lymphoma.