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Antibody-Drug Conjugates: Precision In Cancer Therapy

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Abstract

Despite major advancements in diagnosis and treatment, cancer continues to rank among the world's leading causes of morbidity and mortality. Despite its effectiveness against rapidly multiplying cancer cells, conventional chemotherapy lacks selectivity and frequently results in severe systemic damage, drug resistance, and tumor recurrence. Through chemically designed linkers, ADCs combine the strong cytotoxic activity of anticancer medications with the great specificity of monoclonal antibodies to deliver payloads to tumor cells selectively while causing the least amount of harm to healthy organs. The best antibody selection, linker chemistry, highly effective payloads, and regulated intracellular drug release after receptor-mediated endocytosis are all critical to the therapeutic efficacy of ADCs. The development of ADC technology, structural elements, mode of action, linker classes, and frequently employed cytotoxic payloads are all covered in this review. It also emphasizes ADCs that are now FDA-approved and their clinical uses in solid tumors and hematological malignancies. Recent developments in site-specific conjugation, next-generation payloads, and linker engineering are also presented. The article also discusses the main obstacles to ADC therapy, such as pharmacokinetic complexity, drug resistance, and antigen heterogeneity. All things considered, ADCs are a quickly developing technology that offers better clinical outcomes and significant potential for the creation of safer and more potent next-generation cancer treatments by combining precise targeting with extremely effective cytotoxic therapy.

Keywords:

Antibody–drug conjugates (ADCs); Targeted drug delivery; Monoclonal antibodies; Linkers; Cytotoxic payloads; Cancer therapy ; Targeted chemotherapy.

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