

Signaling Pathways in Breast Cancer

Molecular Mechanisms, Therapeutic Strategies, and Multidrug Resistance

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Chapter 8 - Antibody-drug conjugates in breast cancer treatment

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Abstract

Antibody-drug conjugates (ADCs) represent a rapidly advancing therapeutic strategy that has significantly expanded treatment options for breast cancer by uniting highly specific antibody targeting with the cell-killing capacity of cytotoxic agents. This chapter systematically examines the scientific foundation and clinical relevance of ADCs, beginning with their structural design, key components, and mechanisms of action within cancer cells. Major molecular targets in breast cancer, including human epidermal growth factor receptor 2 (HER2), TROP-2, and emerging biomarkers, are discussed in relation to tumor biology and target selection criteria. The chapter further reviews clinically approved ADCs, evaluates comparative clinical outcomes, and summarizes ongoing clinical development efforts, with particular attention to HER2-low and triple-negative breast cancer. Pharmacokinetic and pharmacodynamic characteristics, resistance mechanisms, and safety considerations are critically addressed to highlight factors influencing therapeutic success and limitations. Recent technological advances in ADC design, such as improved conjugation methods and novel payload strategies, are also explored. Overall, this chapter discusses the current status, challenges, and future directions of ADCs in breast cancer, emphasizing their growing role in personalized therapy, rational drug design, and integrated treatment approaches.

Keywords

Antibody-drug conjugates; breast cancer; targeted therapy; HER2; TROP-2; personalized oncology

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