IMMUNO-ORIENTED APPROACHES TO PREDICTING AND OPTIMIZING BREAST CANCER THERAPY

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ABSTRACT

This study focuses on the development of immuno-oriented approaches for predicting and optimizing breast cancer therapy. A comprehensive analysis of cytokine profiles (IL-2, IL-6, IL-10, TNF-α, IFN-γ), lymphocyte subpopulations, and immune checkpoint expression (PD-1/PD-L1) was conducted in 290 patients. Significant correlations between immune parameters and treatment outcomes were identified. Integrated clinical-immunological indices were developed to assess antitumor resistance and recurrence risk. The results provide a scientific foundation for individualized immunotherapeutic strategies aimed at improving treatment efficacy, reducing relapse rates, and enhancing the quality of life for breast cancer patients.

Relevance

Breast cancer remains one of the leading causes of cancer-related morbidity and mortality among women worldwide. Despite progress in surgical, hormonal, and targeted therapies, relapse and resistance to treatment continue to pose major challenges. The immune system plays a decisive role in controlling tumor progression and response to therapy. Understanding the interaction between tumor cells and immune mechanisms enables the creation of novel immuno-oriented approaches to predict therapeutic outcomes and optimize treatment. Evaluating cytokine levels, immune cell activity, and immune checkpoint expression offers valuable prognostic and predictive information. Integrating these parameters into clinical decision-making supports the development of personalized strategies that enhance therapeutic effectiveness and improve survival rates in breast cancer patients.

Aim

To develop immuno-oriented prognostic approaches for assessing and optimizing breast cancer therapy outcomes based on clinical and immunological parameters.

Materials and Methods

The study included 290 women aged 28–75 years diagnosed with breast cancer. Clinical evaluation involved tumor staging, histopathological verification, and molecular subtyping. Serum cytokine levels (IL-2, IL-6, IL-10, TNF-α, IFN-γ) were determined by ELISA, and PD-1/PD-L1 expression was assessed by flow cytometry. Lymphocyte subpopulations were analyzed to characterize immune activity. Statistical analysis was performed using IBM SPSS 26.0, applying Mann–Whitney and Spearman correlation tests, with significance set at $p<0.05$.

Results

Patients with advanced breast cancer showed elevated IL-6 and TNF-α levels, increased PD-L1 expression, and decreased T-helper and NK-cell counts compared to controls. Significant correlations were found between PD-L1 expression and tumor progression ($r=0.63$; $p<0.01$). Developed immuno-oriented indices accurately predicted treatment response (86%) and recurrence risk. Integration of immune biomarkers into therapeutic monitoring improved treatment personalization and early detection of resistance. The findings validate the prognostic utility of immune-based parameters in optimizing breast cancer therapy.

Conclusion

Immuno-oriented prognostic models based on cytokine profiles and immune checkpoint expression significantly enhance the prediction and optimization of breast cancer treatment. High IL-6, TNF-α, and PD-L1 levels indicate suppressed antitumor immunity and unfavorable prognosis. The proposed integrated indices and algorithm allow individualized therapy adjustment and effective monitoring of treatment dynamics. Implementing immune-based approaches in clinical oncology contributes to more accurate prognosis, reduced recurrence rates, and improved long-term outcomes, supporting the advancement of personalized, immune-driven cancer management..

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