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Letter to the Editor

A Promising Combination Therapy Against Breast Cancer: Integrating Artificial Intelligence, Oncolytic Virotherapy, Probiotic Therapy, Stem Cell Therapy, and Immunotherapy

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To the editor,

Breast cancer remains one of the leading causes of cancer-related mortality worldwide, necessitating innovative and multifaceted therapeutic strategies. [1] We propose a promising combination approach that synergizes Artificial Intelligence (AI), oncolytic virotherapy, probiotic therapy, stem cell therapy, and immunotherapy to target breast cancer more effectively.

AI has transformed cancer diagnostics, prognostics, and therapeutic optimization by enabling precision medicine through large-scale data analysis and predictive modeling. [2] AI-driven algorithms can stratify patients based on molecular subtypes and predict individual responses to treatment, facilitating real-time therapeutic adjustments. [3]

Oncolytic virotherapy represents a powerful, targeted approach, where genetically modified viruses selectively infect and lyse tumor cells while activating systemic antitumor immunity. [4] Clinical trials with viruses such as talimogene laherparepvec (T-VEC) have shown promising results, and combining this modality with immunotherapy further enhances antitumor responses. [5]

Probiotic therapy contributes to modulating the gut–immune–tumor axis. [6] Emerging evidence suggests that gut microbiota can significantly influence the host immune response and impact the efficacy of immunotherapy. [7] Specific probiotics may enhance the anti-cancer effects of immune checkpoint inhibitors and reduce therapy-associated toxicity. [8]

Mesenchymal stem cells (MSCs) possess tumor-homing capabilities and can serve as delivery vehicles for therapeutic agents, including oncolytic viruses or immune

modulators. [9] Engineered MSCs offer a safe and efficient means to localize treatment, reducing systemic toxicity and increasing therapeutic efficacy. [10]

Finally, immunotherapy, including immune checkpoint inhibitors and chimeric antigen receptor-T (CAR-T) cell therapy, has redefined cancer treatment paradigms. However, challenges such as immune escape and resistance remain. [11] Integrating AI for patient selection, probiotics for immune modulation, and oncolytic viruses for tumor sensitization may overcome these hurdles.

The convergence of these therapeutic innovations offers a powerful platform against breast cancer, potentially improving survival and quality of life while minimizing adverse effects. Future clinical trials should explore this integrative strategy, guided by AI models for optimal combination timing and dosing. We believe this multi-pronged approach, grounded in precision and personalization, represents a transformative direction for breast cancer therapy.

AUTHORS' CONTRIBUTION

All authors contributed to the completion of this work. The final manuscript was read and approved by all authors.

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CONFLICT OF INTEREST

None.

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