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(REVIEW ARTICLE)

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Allergic Reactions and Solid Tumors

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Abstract

The effect allergies have on cancer is complex. Immune cells associated with the allergy cascade produce anti-inflammatory, pro-inflammatory, or pleiotropic cytokines. Allergies and solid tumors may have a paradoxical relationship based on the cytokine expression and concentration. Rapid release of pro-inflammatory cytokines into the tumor microenvironment (acute allergic reaction) may stimulate the immune system to disrupt a solid tumor. Alternatively, a slow release of pro-inflammatory cytokines (chronic allergic reaction) may suppress the immune system's ability to disrupt the tumor. This review discusses acute-allergy cancer immunotherapy wherein pro-inflammatory cytokines are rapidly released in the tumor microenvironment to inhibit formation, growth, and metastasis.

Keywords: Allergy; Cancer; Cytokine; Metastasis; Pro-inflammatory; Tumor

1. Introduction

Metastasis of solid tumors causes many deaths [1]. Can allergies inhibit metastasis? The allergy cascade is an inherent part of the immune system; evidence indicates it may have an anti-cancer effect [2]. Allergy-assisted cancer therapy may improve patient outcomes by stimulating natural immunity, increasing resistance to secondary infection, and decreasing immune tolerance [3]. Combining immune checkpoint inhibitors with allergy-assisted cancer therapy could improve immune specificity and help inhibit the tumor microenvironment [4].

The allergy cascade reflects an overactive immune system, while cancer is often associated with a suppressed immune response - a paradoxical relationship. Chronic inflammation caused by allergies can promote carcinogenesis, but this effect is usually localized. Conversely, the enhanced immunosurveillance associated with allergies can help protect against cancer [5]. Overall, individuals with allergies tend to have a reduced risk of developing cancer; however, certain types of cancer, including bladder cancer, lymphoma, myeloma, and prostate cancer, may have increased risk [6].

The paradoxical relationship between allergies and solid tumors may involve the potential to release pro-inflammatory cytokines. Emerging research suggests that certain aspects of acute allergic reactions and the immune cells involved hold potential for anti-cancer effects [7].

The allergy cascade can manifest either as an acute allergic reaction or as a chronic allergic reaction. Acute allergic reactions are associated with a rapid release of pro-inflammatory cytokines compared to chronic allergic responses. Several cytokines mediate acute inflammatory reactions, namely IL-1, IL-6, IL-8, IL-11, IL-16, IL-17, Eataxia, G-CFS, GM-CSF, and TNF-Alpha [8]. In severe allergic reactions, IL-2, IL-6, IL-10, and TNF receptor I were significantly elevated in patients with severe reactions [9].

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Targeted degranulation may disrupt the immune-tolerance capability of malignant tumors and improve patient outcomes [10]. Mast cells have been recognized as key orchestrators of anti-tumor immunity [11]. Degranulation of IgE-primed effector cells in the tumor microenvironment releases cytotoxins that may inhibit malignancy [12].

There remains a need to investigate the potentiality of acute-allergy cancer immunotherapy as an adjuvant immunotherapy to inhibit solid tumor development, growth, and metastasis.

2. Discussion

Acute-allergy cancer immunotherapy involves developing, intensifying, and maintaining the allergy profile. Severe allergic reactions (anaphylaxis) during solid tumor insult and its symptoms can be safely controlled and alleviated with epinephrin and allergy relief medications [13].

3. Development

When a patient is free of allergies or has pre-existing allergies, a skin cream containing allergens, as described in U.S. Patent number 11,911,463, can be used to trigger an acute allergic response [14].

Severely immunocompromised patients may benefit from allergy-assisted passive immunotherapy. This approach suggests an anti-tumor strategy by transferring allergen-specific immunoglobulin E (IgE) antibodies from atopic donors to cancer patients through transfusion. Controlled exposure to the IgE-specific allergens causes localized degranulation and inflammation within the tumor microenvironment [15].

4. Intensification

A skin cream containing allergens is applied to the skin over a period (e.g., hours or days) to provide the individual with continuous exposure to the immunologic agents. The specific amounts of protein allergen and immunologic adjuvant in the skin cream will depend upon a variety of factors such as patient age, body weight, general health, sex, diet, time of administration, allergen-immunologic adjuvant combination, and the severity of cancer in the individual undergoing therapy. An increased serum IgE concentration and histamine levels determine the intensity of the allergic reaction.

5. Maintenance

After acute allergy cancer immunotherapy, allergy maintenance may inhibit cancer recurrence. Cancer patients can achieve remission, during which all signs and symptoms of the cancer disappear. However, complete remission is often not permanent, and the disease may reappear. Interestingly, the allergy cascade may protect against cancer recurrence. Allergy maintenance after cancer remission may prevent the recurrence of life-threatening cancer [16].

6. Conclusion

The complex relationship between allergies and cancer warrants further research to harness the potential anti-cancer effects of allergies. Acute allergy-based cancer immunotherapy investigates the rapid release of pro-inflammatory cytokines into the tumor microenvironment to combat solid tumors and metastasis. This targeted destruction could evolve into a natural cancer immunotherapy for malignant tumors.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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