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Allergy and diabetes:

what should we know?

Allergic diseases and diabetes mellitus (DM) are 2 of the most frequent chronic conditions worldwide. Both carry a high health burden, significantly affect quality of life, and may coexist in the same patient. Allergy is defined as an exaggerated immune response of the body to common environmental substances (allergens) such as aeroallergens, foods, or drugs. Diabetes mellitus, in turn, is a metabolic disorder characterized by persistent hyperglycemia caused by impaired insulin secretion, resistance to insulin action, or both.

In this article we review the epidemiology, immunological and metabolic mechanisms involved, clinical implications, and future research directions concerning the coexistence or interaction between allergy and diabetes. **Although these diseases differ in their pathophysiology, several studies suggest that they share immunological mechanisms**. Low-grade chronic inflammation, immune dysfunction, and alterations in the intestinal microbiota may serve as pathophysiological links between the 2 conditions (1).

PATHOPHYSIOLOGICAL RELATIONSHIP BETWEEN ALLERGY AND DIABETES

Both allergic diseases and diabetes involve immune system dysregulation. In type 1 diabetes, mellitus which is autoimmune in nature, the immune system destroys insulin-producing pancreatic beta cells. In allergic diseases, the immune system reacts to external antigens through a Th2-type response, with the release of histamine, leukotrienes, and cytokines (IL-4, IL-5, IL-13).

EPIDEMIOLOGY

Several recent studies have explored the coexistence of allergic diseases (asthma, rhinitis, dermatitis) and type 1 diabetes mellitus (T1DM), with heterogeneous results. A 2024 review reported that the prevalence of asthma in patients with T1DM ranged from 1.7% to 23.1% (2). Likewise, a 2025 genetic analysis showed that shared genetic factors partially explain the comorbidity between allergic disease and T1DM (4).

Although most studies have focused on T1DM, the relationship with type 2 diabetes mellitus (T2DM) has also been explored. For example, a Korean population study found a bidirectional association between allergic rhinitis and DM (3). In children and adolescents with T1DM, the use of continuous glucose sensors has been associated with a 7.9% prevalence of allergic contact dermatitis (7). Meanwhile, T2DM, characterized by low-grade inflammation, may facilitate cutaneous and drug hypersensitivity phenomena (8).

POSSIBLE MECHANISMS OF INTERACTION

The classic Th1/Th2 paradigm does not fully explain the coexistence of allergy and diabetes. Recent studies indicate overlapping immune pathways, including alterations in regulatory T cells (Treg) and in the expression of IL-2, T-bet, and Foxp3, common to both conditions.[5] Intestinal microbiome dysbiosis has also been proposed as a shared pathogenic link (8).

In T2DM, low-grade inflammation and oxidative stress may modulate immune responses, favoring allergic sensitization (9). Furthermore, epithelial barrier dysfunction and exposure to adhesives or materials from medical devices may trigger dermatitis.

Shared environmental factors—high-calorie diet, obesity, sedentary lifestyle, and stress—may exacerbate both conditions.

ALLERGY TO INSULIN AND ORAL ANTIDIABETIC DRUGS

Allergic reactions to insulin are infrequent but still clinically relevant. Estimated prevalence ranges from 0.1% to 2% of treated patients (10). Signs include local erythema and pruritus up to generalized urticaria or anaphylaxis. The allergen may be the insulin molecule per se or excipients (metacresol, protamine, zinc). Reactions may be type I (IgE-mediated), type III (immune complex), or type IV (delayed hypersensitivity). Diagnosis is based on clinical history, skin testing, specific IgE detection, and controlled exposure tests.

Management ranges from changing the formulation or route of administration to desensitization when necessary. A retrospective study of more than 30 patients showed that most responded favorably to insulin substitution or temporary use of oral antidiabetic drugs (11). Education on injection technique is essential, as inadvertent intradermal administration may intensify reactions.

Regarding oral antidiabetic drugs (OADs), true allergy is rare, but hypersensitivity reactions to metformin, vildagliptin, other DPP-4 inhibitors, and some SGLT2 inhibitors have been documented. Cutaneous reactions range from mild rashes to severe syndromes such as DRESS or Stevens–Johnson syndrome. Drug discontinuation is usually sufficient, though some cases require hospitalization (12).

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BOTH ALLERGIC DISEASES AND DIABETES INVOLVE ALTERATIONS OF IMMUNE PROCESSES. IN TYPE 1 DIABETES MELLITUS, OF AUTOIMMUNE ORIGIN, THE IMMUNESYSTEM DESTROYS THE INSULIN-PRODUCING PANCREATIC BETA CELLS

CUTANEOUS REACTIONS RANGE FROM MILD RASHES TO SEVERE CONDITIONS SUCH AS DRESS OR STEVENS–JOHNSON SYNDROME. DRUG WITHDRAWAL IS USUALLY SUFFICIENT, ALTHOUGH SOME CASES REQUIRE HOSPITALIZATION

» CLINICAL IMPLICATIONS AND MANAGEMENT

Early recognition of potential allergy to antidiabetic medications is essential to prevent serious complications and maintain adequate glycemic control. Referral to an allergy specialist is recommended for diagnostic confirmation. Changes in therapeutic class or desensitization should be evaluated on an individual basis. Communication be- »

» tween endocrinologists and allergists is crucial for optimal patient management.

IMPACT OF ALLERGY TREATMENT ON DIABETES

There is limited direct evidence that specific allergy treatment modifies the course of diabetes in terms of incidence or glycemic control. However, relevant clinical considerations include:

- **Corticosteroid** use (eg, during allergic exacerbations) may increase blood glucose, worsen insulin resistance, and require higher insulin doses.
- **Allergen immunotherapy** may theoretically modulate immune responses systemically, but no robust trials have evaluated its impact on diabetes risk.
- Since allergic diseases involve mast cell, basophil, and inflammatory cytokine activation, **effective allergy control could reduce systemic inflammatory burden and potentially influence metabolic profiles**.

Future Perspectives and Research Directions

- Conduct prospective studies to define the causal direction between allergy and diabetes.
- Characterize patient subgroups with combined allergy–diabetes phenotypes.
- Analyze the role of the intestinal microbiome. D

CONCLUSIONS

- The coexistence of allergy and diabetes is more common than previously thought, sharing immune interactions and being influenced by genetic and environmental factors.
- In allergic patients with diabetes, especially those treated with oral or systemic corticosteroids, blood glucose should be closely monitored.
- In patients treated with insulin or OADs, potential allergic reactions to these drugs must be carefully observed.
- Accurate diagnosis and individualized management are key to avoiding unnecessary treatment discontinuation.
- Modern lifestyle, microbiome alterations, stress, and systemic inflammation are important contributors to both conditions.
- Patient education and clinical surveillance are fundamental pillars of prevention.

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