

# Risk Factors and Management of Type 1 Diabetes

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**Abstract.** Type 1 diabetes (T1D) is an organ-specific autoimmune disease in which the selective destruction of islet B cells mediated by the T lymphocytes leads to absolute insulin deficiency, especially result from the interaction between genetic and non-genetic factors which is prevalent among teenagers all over the world. However, there also a lot of challenge in clinical and the trigger of the T1D. This essay comprehensively review the currently study of etiology, epidemiology, and management of T1D. he essay mainly aim at understanding the theory of disease as the result of improve in the therapeutic schedule. Moreover, recent innovation in immunotherapy especially in specific islet immune pathways and innovations in non-invasive blood glucose monitoring technologies make the therapy for the patient more efficient and more. At the same time, it is hoped that there will be more relevant studies in the future to continuously improve the understanding of its heterogeneity and prognostic markers, and improve and develop treatment strategies and management methods, so as to benefit patients.

**Keywords:** T1D; factor; treatment; education.

## 1. Introduction

Type 1 diabetes(T1D) is a chronic systemic autoimmune mediated disease characterized by the insulin deficiency and the high blood sugar. The incidence accounts for only about 5–10%. However, its incidence continues to increase worldwide [1]. In the 1980s and 1990s, the incidence of T1D in China was about 0.51 per 100,000 people per year. Unlike Tye 2 Diabete, T1D is not caused by life habits such as lack of exercise and overweight, it is an autoimmune disease which is caused by immune system mistakenly destroys beta cells in insulin prodeded by pancreas. as a result, the blood sugar level continuous increase due to insulin deficiency and need for exogenous insulin therapy [2].

The early T1D is very obvious action that destruction of ADAR acting on beta cells trigger a massive inteferon response, islet inflammation and beta cell failure and destruction, ultimattely leading to diabetes. However, as beta cell destruction continuous, insulin production declines to the point where exogenous insulin therapy becomes necessary for survival [3].

Although it is currently possible to control a patient's blood sugar levels with insulin injections, inaccurate estimates of insulin volume can cause both short - and long-term problems due to dietary factors, intensity and duration of physical activity and there still exist in the understanding of T1D and the ability to standardise clinical care and decrease the complications and burden [4]. The main aim of the paper is to synthesize the knowledge of T1D and discuss the hot spot of the disease and enhanced treatment modalities according to individual patient.

## 2. Risk Factors

### 2.1. Genetic Factor

There are at least 10 genes can be point out as important cause for the disease which is revealed by genetic mapping and genetic phynotype studies [5]. The most noticeable genetic markers are located within the Human Leukocyte Antigen (HLA) region on the chromosome 6. Structure and function of both HLA-DQ and DR peptide-binding pockets determine disease susceptibility and resistance which is provided by certain evidence [6].

Studying the susceptible sites of T1D will not only help to further understand the mechanism of the development of the disease, but also establish a predictive model of T1D. Early predictive models

were mostly based on islet autoantibodies, islet B-cell function (e.g., INS or C-peptide assesses) glucose metabolism, other clinical parameters (e.g., age, body mass index), and genetic factors. Recent studies have reported that incorporating newly discovered non-HLA variants and applying more robust predictive modeling methods can significantly improve the ability to predict risk

## 2.2. Environment Factor

Environmental factors are increasingly recognized as significant contributors to the cause of T1D, especially in individuals who are genetically predisposed. These factors are believed to act as triggers that initiate or exacerbate the autoimmune process. T lymphocytes infiltrate the islets of pancreas and destroy the beta cell population which is produced by insulin. One of the primary ways in which environmental factors may influence the development of T1D is through their impact on the gut immune system.

Among the various environmental factors, dietary factors have earned huge attention, particularly the role of cow's milk (CM) in early childhood [7]. The theory suggests that early exposure to cow's milk proteins might provoke an autoimmune response in genetically susceptible infants. The hypothesis that cow's milk proteins may act as a trigger for T1D has remained controversial for a decade [8].

Also, studies have shown that intestinal flora plays an important role in the pathogenesis of metabolic syndrome components such as abnormal glucose metabolism, and increased intestinal permeability or "intestinal leakage", decreased microbial diversity and increased number of inflammatory species have been observed in many patients. In addition, intestinal microflora studies in children at high risk of the T1D have found that, the number of *Bacteroides*, *haematococcus*, *Diplococcus cryptopteri* and *bifidobacterium longum* was more than that of the normal group, while the number of *bifidobacterium pseudostreptococcus* and *bifidobacterium* were relatively less [9].

## 3. The Incidence of T1D is Seasonal

The incidence of T1D is characterized by seasonal prevalence, with the highest incidence in autumn and winter (October). In the northern Hemisphere, the number of newly diagnosed T1D cases is higher in autumn and winter than in spring and summer. The incidence in northern China is higher than that in southern China, and has a cyclical tendency, and the incidence increases in cold regions and winter. The reason may be related to the cold climate, which may lead to mutations in certain inherited genes, affecting one or more metabolic pathways, resulting in elevated blood sugar and glycerol and other protective adaptations against cold. This seasonal trend is especially common in those who develop the disease before and after puberty, and those who develop the disease within 1 year of age are not obvious. This may be due to the fact that the destruction of islet B cells has begun years before the onset of clinical disease, and this seasonal change may simply reflect seasonal changes in individual sensitivity to environmental predisposing factors for diabetes. In addition, in the cold winter season, the body's demand for endogenous insulin increases, which causes subclinical diabetes in people whose B cells have been partially destroyed. The incidence of the disease was low in spring and summer, but high in winter and autumn, suggesting the possibility of infection. In addition, the level of disease occurrence is consistent with the prevalence of viral infection. Neonatal morbidity was strongly associated with maternal viral infection (peak in January). This suggests that the virus infection of the mother is transferred to the fetus through some way, causing the destruction of the fetal islets. At present, due to the differences of survey objects, number of people, nationalities and regions, the results may be different, and further exploration is still needed [10].

## 4. Treatment

### 4.1. Insulin Therapy

The goal of treating type 1 diabetes is to eliminate hyperglycemia, reduce microvascular and macrovascular complications, and enable patients to live a normal lifestyle. The internationally

renowned experimental results of diabetes control and complications show that hyperglycemia is significantly related to chronic complications of diabetes. Intensive insulin therapy can enable type 1 diabetes patients to achieve near-normal blood sugar control, which can delay and reduce the occurrence of complications. Among them, multiple subcutaneous insulin injection (MDI) and continuous subcutaneous insulin infusion (CS II) are currently accepted as intensive treatments for T1D. Especially for children or adolescents, the use of CSII can reduce the number of daily subcutaneous injections compared to MDI, which is important for children who are afraid of injections. In addition, insulin pumps are more flexible in life, so for older children and adolescents, the use of insulin pumps can make their sports and social activities more convenient [11].

#### 4.2. Immunotherapy

At present, insulin therapy is still the main treatment method, but it cannot fundamentally solve the problem of islet dysfunction. People begin to expect etiological therapy -- immunotherapy to prevent or delay the damage of  $\beta$  cells and protect the remaining islet function to prevent or even reverse T1D. And years of immunotherapy, including targeting T cells, B cells, inflammatory cytokines, and microbial origins, are beginning to pay off. Anti-cd3 monoclonal antibodies induce effector T cells to clear or make T cells unresponsive to target antigens by modulating T cell receptor (TCR). Teplizumab is an Fc receptor unbinding anti-CD3 monoclonal antibody. In a Phase II randomized study, Sims et al. found that Teplizumab delayed  $\beta$  cell function decline in people at high risk of T1D, improved insulin secretion quantitatively and qualitatively, and delayed disease progression over a period of nearly 5 years [12,13].

#### 4.3. Education and Management

Self-management is a process that supports T1D patients to acquire the necessary knowledge, skills and confidence to conduct self-management. It may effectively improve patients' self-management ability and improve metabolic control and is the cornerstone of whole-course management. Especially for adolescents or children, their disease self-management ability is low, which often affects the control of blood sugar. Therefore, in the process of encouraging patients to actively participate in self-management, the role of families, schools and medical institutions should be given full play, attention should be paid to the psychological status of patients' families, and knowledge and skills should be provided to families. Improve school support in terms of system, equipment, site provision, emergency management, etc. On the basis of learning from foreign research results, we can fully consider the characteristics of national conditions and make use of existing resources to find a suitable development model [14].

Diabetes distress refers to a negative emotional response caused by concerns about the emotional burden, treatment, self-management and disease support related to diabetes. Identifying factors related to diabetes distress can help prevent and improve diabetes distress and its adverse effects, and better self-management, some studies have shown. Diabetes distress in adolescents with T1D was associated with age, HbA1c, depressive symptoms, psychological resilience, and parental diabetes distress. In the future, multi-center, large-sample and different types of studies should be carried out to include more relevant factors and effect sizes to further explore the factors related to diabetes distress in adolescents with T1D [15].

#### 4.4. New Strategy

Stem cell therapy has become a hot research and exploration in recent years. Using the ability of stem cells to differentiate into various cell types, stem cells were induced to differentiate into islet beta cells under strict control conditions in vitro. VX-880, a fully differentiated islet cell replacement therapy derived from allogenic human embryonic stem cells developed by Vertex, has entered the clinical trial stage. A phase 1/2 clinical trial was planned to include a total of 17 T1D patients, 6 patients received VX-800 treatment, insulin secretion was restored to varying degrees, C-peptide

levels were significantly increased, and blood glucose control was improved; After more than 1 year of VX-800 treatment, 2 patients stopped insulin and had normal blood sugar [16].

## 5. Conclusion

T1D is a serious and challenge health problem especially for the teenagers all over the world. Although the destruction to the beta cell by the self-immune system already been confirmed but the need the further study for the teenagers. Insulin therapy, immunotherapy and glucose monitoring offer already improved management, also still have potential to improve in the education.

The morbidity continuous grow in all of the world because of the more junk food but less exercise. The interplay between the environment and genetic factor plays a crucial role in development of T1D and effect the diabete. This passage highlights how these factors have effect on the development. Due to the autoimmune nature of T1D, the characteristic of the disease is the immune system mistakenly attack the beta cells in pancreatic so it is necessary for us to learn how disease's pathogenesis work to improve the result of the treatment.

The immunotherapy and glucose monitoring technologies give significant help to the treatment. The new method that focusses on islet-specific immune pathways aim to mitigate the speed of disease develop instead of the tradition way such as broad immunosuppression. Non-invasive blood glucose monitoring and life habit also improve the self-management and life quality of the patients.

In a word, T1D is still an intricate disease and need continuous research and special treatment for the individual. Educating the patients and family for self-management, integrating the new technologies and advancing therapeutic strategies is very important for the management of T1D better and alleviate the impact for the individual.

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