

# Type 1 Diabetes



Diabetes | Umbilical Cord Blood



Type 1 diabetes is an autoimmune disease that causes the beta cells of the pancreas to be destroyed. This results in insufficient insulin being produced, and therefore uncontrolled sugar levels in the blood.

The cause of type 1 diabetes may be related to genetic predisposition and environmental triggers. Currently, 3.8 million people in the UK have been diagnosed with diabetes. £9.8 billion a year is spent on it, which accounts for around 10 percent of the NHS budget. £1 billion is spent on treating type 1 diabetes, while the remaining £8.8 billion is spent on treating type 2 diabetes. 79% of these costs relate to treating complications of diabetes rather than the disease itself.

Diabetes increases the risk of heart disease, stroke, limb amputation, blindness, kidney failure, dental disease, neuropathy and premature death. It usually precludes being able to obtain private medical insurance due to the high risk of future health issues, and can also impact on employment opportunities.

The focus of current treatments is insulin replacement and lifestyle management. To address the root cause of the disease, insulin-producing cells must be tolerated by and thrive in the affected body. Pancreas and islet transplantation has been successful, but requires immune modulation of the recipient to prevent the autoimmune reaction. This can have long-term consequences.

## Clinical Trials

Currently, the clinical trials registry notes 47 trials investigating treatments of type 1 diabetes. Seven of these have, or are recruiting patients to investigate treatments using cord blood stem cells. The results are positive, but the long-term benefits are still under investigation.

A stem cell educator trial (NCT01415726) has been conducted where T cells from the diabetic patient are co-cultured with cord blood from healthy donors. 15 type 2 diabetic patients were treated, with long-term follow up results to be published. This study has now been extended, and is currently recruiting for type 1 diabetic patients. There is also a study using cord blood derived mesenchymal stem cells, which is due to report soon.

## Cell Line

Production of a stable cell line of insulin-producing beta cells has been achieved at the University of Pittsburgh to study immune response and help test possible therapies for it.

## Patient Studies

Some smaller patient studies have been conducted and published. 11 children were treated with their own cord blood at the University of Florida and followed up for 3 to 13 months. The study showed that immediately after treatment the requirement for insulin was lower than before treatment. This has not been shown to be a long-term solution, as the reduced insulin requirement was not seen at a post 12-month follow up.

A 57-patient randomised study reported by Hu et al shows a stem cell preparation from human umbilical cord Wharton's Jelly can reduce or ameliorate the need for insulin in patients under 25 years of age who had stable glucose and insulin levels for at least one month prior to treatment. This provides a baseline of efficacy and treatment dose, but requires more detailed work. The follow up term for this study was 24 months, but a much longer-term follow up is required.

## Future Research

Immune modulation by mesenchymal stem cells (MSC) is a phenomenon that is poorly understood, but has huge implications for most diseases and injuries. MSCs are known to act in several ways in the immune system, and the overall result is the release of pro-inflammatory substances.

## Summary

The incidence of type 1 diabetes and its associated morbidity and mortality are a global concern. While the exact mechanism of the disease is not clearly understood, improvements in the understanding of how certain stem cells affect the immune system, and how the specific cells affected can be protected, are the focus of current research efforts.

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