



Nutritional Management of Type 3c Diabetes

Rachel Ewing
Advanced Practice Diabetes Dietitian
South Eastern Health and Social Care Trust

Learning Outcomes

Improved knowledge and understanding of Type 3c Diabetes management in patients with pancreatic diseases.

Overview

- ▶ Diabetes and Classification
- ▶ What is Type 3c Diabetes
- ▶ Characteristics and differences from other types of diabetes
- ▶ Prevalence
- ▶ Diagnosis
- ▶ Treatment and Management
- ▶ Nutritional considerations
- ▶ Challenges and importance of glycaemic control
- ▶ Case studies

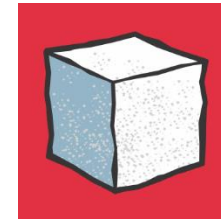
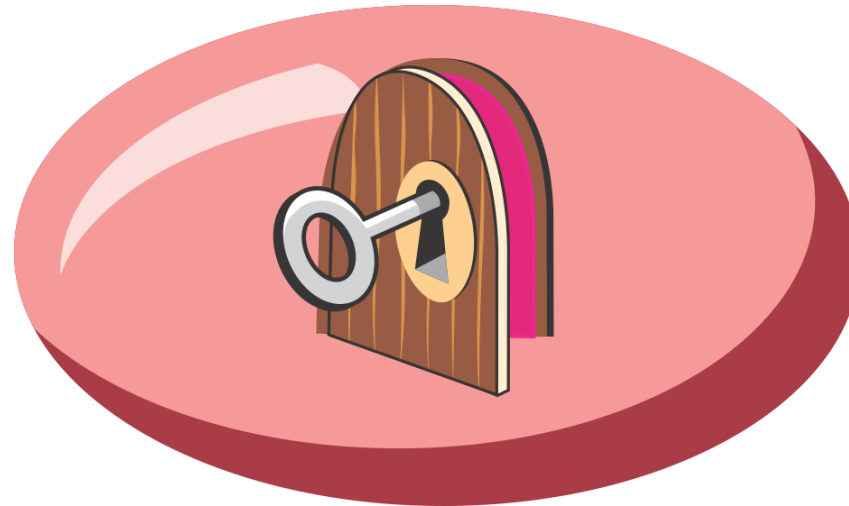
What is Diabetes?

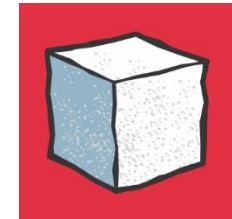
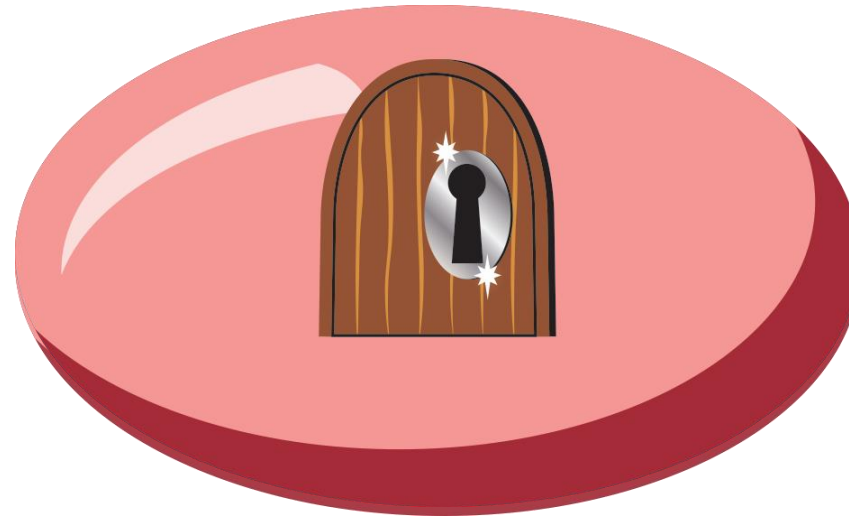
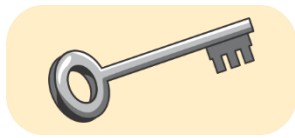
- ▶ Diabetes is a condition where the amount of **glucose in the blood is too high**.
- ▶ This can be due to the **inability** of the body **to produce insulin**, or the insulin that is produced is **not being used properly**.

Poll Question:

What is the Main Role of Insulin?

- a) Filters the blood and removes waste products
- b) Move glucose from our bloodstream into the body's cells to make energy**
- c) Converts glucose into glycogen for storage
- d) Absorbs cholesterol in the blood and carries it back to the liver





Types of Diabetes

- ▶ Type 1 Diabetes
- ▶ Type 2 Diabetes
- ▶ Gestational Diabetes
- ▶ Maturity Onset Diabetes of the Young (MODY)
- ▶ Neonatal Diabetes
- ▶ Latent Autoimmune diabetes in Adults (LADA)
- ▶ **Type 3c Diabetes**
- ▶ Steroid-Induced Diabetes

Activity

Definition & Characteristics

- ▶ Type 3c diabetes is **diabetes secondary to pancreatic disease / damage to the pancreas**
- ▶ Also known as **pancreatogenic diabetes**
- ▶ Characterised by **progressive insulin deficiency.**
- ▶ Associated conditions – **acute/chronic pancreatitis, pancreatic cancer, pancreatic surgery, cystic fibrosis, haemochromatosis.**

Characteristics

Parameter	Type 1 IDDM	Type 2 NIDDM	Type 3c Pancreatogenic
Ketoacidosis	Common	Rare	<u>Rare</u>
Hyperglycemia	Severe	Usually mild	<u>Mild</u>
Hypoglycemia	Common	Rare	<u>Common</u>
Peripheral insulin sensitivity	Normal or increased	Decreased	<u>Increased</u>
Hepatic insulin sensitivity	Normal	Normal or decreased	<u>Decreased</u>
Insulin levels	Low	High	Low
Glucagon levels	Normal or high	Normal or high	Low
PP levels	Normal or low (late)	High	Low
GIP levels	Normal or low	Normal	Low
GLP1 levels	Normal	Normal or low	Normal or high
Typical age of onset	Childhood or ado- lescence	Adulthood	Any

IDDM, insulin-dependent diabetes mellitus; NIDDM, non-insulin-dependent diabetes mellitus; PP, pancreatic polypeptide; GIP, glucose-dependent insulinotropic polypeptide; GLP1, glucagon-like peptide 1. Modified, with permission, from Slezak LA & Andersen DK 2001 Pancreatic resection: effects on glucose metabolism. *World Journal of Surgery* **25** 452–460. Copyright 2001 International Society of Surgery.

Prevalence of Type 3c diabetes

- ▶ **5%-10%** of all diabetes mellitus cases in Western populations
- ▶ Chronic pancreatitis accounts for up to **80%** of all type 3c diabetes mellitus cases
- ▶ Could be higher as often cases are misclassified

Diagnosis

Table 2 Proposed diagnostic criteria for type 3c diabetes mellitus

Major criteria (must be present)

Presence of exocrine pancreatic insufficiency (monoclonal fecal elastase-1 test or direct function tests)

Pathological pancreatic imaging (endoscopic ultrasound, MRI, CT)

Absence of type 1 diabetes mellitus associated autoimmune markers

Minor criteria

Absent pancreatic polypeptide secretion

Impaired incretin secretion (*e.g.*, GLP-1)

No excessive insulin resistance (*e.g.*, HOMA-IR)

Impaired beta cell function (*e.g.*, HOMA-B, C-Peptide/glucose-ratio)

Low serum levels of lipid soluble vitamins (A, D, E and K)

MRI: Magnetic resonance imaging; CT: Computed tomography; GLP-1: Glucagon-like peptide-1; HOMA-IR: Homeostasis model assessment of insulin resistance; HOMA-B: Homeostasis model assessment of beta-cell.

Treatment and Management

NICE guideline [NG104] - Pancreatitis

- ▶ Offer people with chronic pancreatitis monitoring of HbA1c for diabetes at **least every 6 months** (lifetime risk as high as 80%)
- ▶ Assess people with type 3c diabetes **every 6 months** for potential benefit of insulin therapy.
- ▶ For people who are **not using insulin** – refer to NICE guidelines on type 2 diabetes
- ▶ For people **who need insulin** – refer to NICE guidelines on type 1 diabetes

Therapeutic
Treatment Options
for
Type 3c Diabetes

▶ **Glucose lowering agents**

e.g. Metformin

▶ **Insulin therapy**

e.g. basal bolus, biphasic/mixed, pump therapy

Therapeutic Treatment Options for Type 3c Diabetes

- ▶ Treatment depends on level and the cause of the damage to the pancreas
- ▶ If the whole pancreas has been removed, insulin therapy is required
- ▶ Otherwise, individual assessment needed to determine which treatment is most appropriate
- ▶ Progression to insulin more likely than in type 2 diabetes
- ▶ Estimated 50% of those with Type 3c diabetes may require insulin therapy
- ▶ No clinical studies to determine what is the most effective insulin regimen for type 3c diabetes secondary to pancreatitis

Nutritional Management of Type 3c Diabetes

Principles

- Prevent/treat malnutrition
- Control malabsorption symptoms
- Stabilise blood glucose levels

Nutritional Management of Type 3c Diabetes

Strategies

- ▶ Regular meal pattern - avoid skipping meals. Consider “little and often” approach if appetite poor
- ▶ Regular starchy carbohydrates
- ▶ Minimise high sugar / high glycaemic index foods and drinks with little to no nutritional value
- ▶ Adequate dosage and correct use of pancreatic enzyme replacement therapy (PERT)
- ▶ Avoid alcohol and smoking
- ▶ Frequent blood glucose monitoring
- ▶ Dietitian assessment and review

Table 3. Suggested Self-Monitoring Regimen for Blood Glucose Testing in T3cDM*

Minimum 6-10 blood glucose testing occasions per day:

- Prior to all meals and snacks
- Occasionally post-prandially
- Before bed
- After physical activity
- In the presence of suspected hypoglycemic symptoms
- After treating for hypoglycemia until normoglycemia is maintained
- Before critical tasks e.g. driving, swimming, using dangerous equipment, etc.

**Based on ADA self-monitoring blood glucose testing for T1DM and T2DM patients on intensive insulin regimens³⁸*

Carbohydrates

- ▶ Main source of fuel for the body
- ▶ Broken down into “glucose”
- ▶ Two main categories
 - Sugary/simple e.g. sweets, desserts, fruit juice
 - Starchy e.g. bread, potato, pasta
- ▶ Fibre
 - Found in wholegrains, wholemeal products, fruits and vegetables, pulses
 - Helps blood glucose control as broken down more slowly
 - Keeps our digestive system healthy and other health benefits



Source: Public Health England in association with the Welsh Government, Food Standards Scotland and the Food Standards Agency in Northern Ireland

All our copy rights 2016

Carbohydrate Awareness & Counting for Insulin Dose Adjustment

Initial Education

- ▶ What are carbohydrates
- ▶ Role in diet
- ▶ How different types affect blood glucose
- ▶ Hypoglycaemia – depending on treatment



Structured Meal Plan

- ▶ Basal bolus / Biphasic Insulin regimens
- ▶ Individualised – may not be appropriate for all
- ▶ Dietitian will work out carbohydrate intake based on habitual intake
- ▶ Devise plan for carbohydrate portions at meals
- ▶ Carbohydrate swaps / exchanges to allow variation in choices and build knowledge



Carbohydrate Counting

- ▶ May be appropriate for those with insulin deficiency
- ▶ Allows flexibility with diet
- ▶ Allows patient to take more ownership of insulin management
- ▶ Diabetes team will establish insulin to carbohydrate ratios e.g. 1:1 (1 unit for every 10g)
- ▶ Educate on weighing out portions, reading food labels and useful tools e.g. Carbs&Cals

Other Nutritional Considerations

- ▶ Pancreatic Exocrine Insufficiency and PERT adequacy – impact on glycaemic control, fibre intake
- ▶ Oral nutritional supplements – carbohydrate content
- ▶ Risk of undernutrition

Challenges with Glycaemic Control

- ▶ Glucose lowering medication and insulin management
- ▶ PERT
- ▶ Impact of other conditions and treatments
- ▶ Diet
- ▶ Patient's understanding
- ▶ Emotional health and well being
- ▶ Driving regulations
- ▶ Employment

Importance of Glycaemic Control

Hyperglycaemia

- ▶ Short term – osmotic symptoms, unintentional weight loss, tiredness, impaired immune system and wound healing
- ▶ Long term – retinopathy, nephropathy, neuropathy, heart disease

Hypoglycaemia

- ▶ Lack of symptom awareness, severity, frequency, fear

Case Study 1

- ▶ 65 year old male
- ▶ Pancreatic exocrine insufficiency on background of Whipples procedure for pancreatic tumour. History of colon cancer with x2 previous resections.
- ▶ Admitted with symptomatic hyperglycaemia – HbA1c 113mmols/mol. Commenced on basal bolus insulin therapy (Lantus and Humalog)

Case study 1

- ▶ BMI 17kg/m².
- ▶ History of 19kg (25%) weight loss over 2 years and further 2kg decrease more recently.
- ▶ Irregular meal pattern prior to diabetes diagnosis.
- ▶ Large Creon doses (25000 units x 10+ capsules per meal). Good compliance and no issues with malabsorption.
- ▶ Due to GI history – unable to tolerate various higher fibre foods.
- ▶ Limited carbohydrate awareness.

What are the Main Nutritional Issues?

- ▶ Unintentional weight loss and low BMI
- ▶ Hyperglycaemia
- ▶ Newly commenced on insulin therapy – risk of hypoglycaemia
- ▶ Limited knowledge and understanding of condition – new diagnosis
- ▶ PEI – high PERT doses

Case study 1

- ▶ Food First Principles & Food fortification
- ▶ Regulate meal pattern, carbohydrate consistency and appropriate snack portions between meals
- ▶ Build carbohydrate awareness – Carbohydrate exchanges / Carbs&Cals
- ▶ Discussion with diabetes team regarding carbohydrate counting however insulin requirements low (Lantus 2 units, Humalog 3/4/3) despite high carbohydrate intake (~ 400g per day) therefore not appropriate
- ▶ **Outcome:** Improved glycaemic control (Latest HbA1c down to 51mmols/mol) weight increased (60kg, BMI 18.5kg/m²)

Case Study 2

- ▶ 52 year old male
- ▶ Distal pancreatectomy and splenectomy for Pancreatic Neuroendocrine Tumour.
- ▶ Admission with diabetic ketoacidosis (DKA). HbA1c 50mmols/mol. Commenced on basal bolus insulin therapy (Lantus and Novorapid).
- ▶ PEI – on PERT

Case Study 2

- ▶ BMI 29kg/m²
- ▶ History of 12% weight loss in 3 weeks.
- ▶ Creon 75,000-100,000 with meals and 25,000-50,000 with snacks. good compliance and no issues with malabsorption.
- ▶ Appetite poor post surgery and following high energy, high protein principles. Appetite and intake since improving.
- ▶ Regular meal pattern but carbohydrate sources mostly refined.

Case Study 2

- ▶ Regulate meal pattern, carbohydrate consistency and appropriate snack portions between meals.
- ▶ Build carbohydrate awareness – carbohydrate exchanges / Carbs&Cals
- ▶ Progressed to carbohydrate counting using insulin to carbohydrate ratios – 1unit for every 10g carbohydrate for self-dose adjustment.
- ▶ **Outcome:** Improved glycaemic control (Time in range 80%) weight stabilised.



Key Takeaways

Questions?

References

- ▶ Cui, Y., & Andersen, D.K. (2012). Endocrine-Related Cancer (2012) 19 F 9 – F 26 Diabetes and pancreatic cancer.
- ▶ Duggan S, & Conlon K,. (2017). Pancreatogenic Type 3c Diabetes: Underestimated, Underappreciated, and Poorly Managed. Practical gastroenterology. 14-23.
- ▶ Ewald and Hardt: Diagnosis and treatment of diabetes mellitus in chronic pancreatitis. World J Gastroenterol. 2013; 19(42): 7276–7281
- ▶ Ewald N, Kaufmann C, Raspe A, et al. Prevalence of diabetes mellitus secondary to pancreatic diseases (type 3c). Diabetes Metab Res Rev. 2012;28(4):338-342.
- ▶ Hart, P.A., Bellin, M.D., Andersen, D.K., Bradley, D., Cruz-Monserrate, Z., Forsmark, C.E., Goodarzi, M.O., Habtezion, A., Korc, M., Kudva, Y.C., Pandol, S.J., Yadav, D. and Chari, S.T. (2016). Type 3c (pancreatogenic) diabetes mellitus secondary to chronic pancreatitis and pancreatic cancer. The Lancet Gastroenterology & Hepatology, 1(3), pp.226–237.
- ▶ National Institute for Health and Care Excellence (2018) Pancreatitis (NICE Guideline 104), Available at: <https://www.nice.org.uk/guidance/ng104> [Accessed November 2022].
- ▶ Public Health England (2016). *The Eatwell Guide*. [online] Gov.uk. Available at: <https://www.gov.uk/government/publications/the-eatwell-guide>.