Non Ketotic Hyperosmolar Coma

Essay

Submitted for the Partial Fulfillment of Master Degree

In Critical Care

By

MOHAMED GAMAL ABD EL SAMEE ZAHRAN

M.B,B., Ch

Under Supervision of

Prof. Dr. Mohsen Abdelghani Bassiony

Professor of Anesthesiology and Intensive Care

Faculty of Medicine–Ain Shams University

Prof. Dr. Mohamed Sidky Mahmoud

Assist. Prof. of Anesthesiology and Intensive Care

Faculty of Medicine–Ain Shams University

Dr. Rania Maher Hussien

Lecturer of Anesthesiology and Intensive Care

Faculty of Medicine–Ain Shams University

Faculty of Medicine
Ain Shams University
2013

Acknowledgements

First and foremost, thanks to **Allah the Almighty** to whom I relate any success in achieving any work in my life.

I would like to express my very great appreciation to **Prof. Dr. Mohsen Abdelghani Bassiony** Professor of Anesthesiology and Intensive Care, Faculty of Medicine, Ain Shams University, for his precious instructions, expert supervision and valuable comments during the course of this work.

I would like to offer my special thanks and deep appreciation to **Prof. Dr. Mohamed Sidky Mahmoud,** Assist. Prof. of Anesthesiology and Intensive Care, Faculty of Medicine, Ain Shams University, for his help and valuable advice throughout the performance of this work.

I would also like to thank **Dr. Rania Maher Hussien,** Lecturer of Anesthesiology and Intensive Care, Faculty of Medicine, Ain Shams University for providing me with very valuable and constructive suggestions, for her support and enthusiastic encouragement.

List of Contents

List of Abbreviation

ADA	**:**	American Diabetes association.
AG	**:**	Anion gap.
AKA	**:**	Alcoholic ketoacidosis.
BUN	**:**	Blood urea nitrogen.
CABG	**:**	Coronary artery bypass grafting.
CDC	**:**	Centers for Disease Control and Prevention.
CTS	**:**	Carpal tunnel syndrome.
DCCT	**:**	Diabetes Control and Complications Trial.
DKA	**:**	Diabetic ketoacidosis.
DM	**:**	Diabetes mellitus.
FPG	**:**	Fasting plasma glucose.
HHNC	**:**	Hyperosmolar hyperglycemic non-ketotic coma.
HHS	**:**	Hyperosmolar hyperglycemic state.
IDDM	**:**	Insulin-dependent diabetes mellitus.
IFG	**:**	Impaired fasting glucose.
IGT	**:**	Impaired glucose tolerance.
LADA	**:**	Latent autoimmune diabetes of adulthood.
MODY	**:**	Maturity-onset diabetes of the young.
NDDG	**:**	National Diabetes Data Group.
NIDDM		Non-insulin-dependent diabetes mellitus.
NIH	**:**	National Institutes of Health.
OGTT	**:**	Oral glucose tolerance test.
WHO	**:**	World Health Organization.

List of Tables

سورة البقرة الآية: ٣٢

Introduction

Hyperosmolar hyperglycemic state (HHS) is one of two serious metabolic derangements that occurs in patients with diabetes mellitus (DM) and can be a life-threatening emergency. It is less common than the other acute complications of diabetes like diabetic ketoacidosis (DKA). HHS was previously termed hyperosmolar hyperglycemic non-ketotic coma (HHNC); however, the terminology was changed because coma is found in fewer than 20% of patients with HHS **(Nugent, 2005).**

HHS most commonly occurs in patients with type II DM who have some concomitant illness that leads to reduced fluid intake. Infection is the most common preceding illness, but many other conditions can cause altered mentation, dehydration, or both. Once HHS has developed, it may be difficult to differentiate it from the antecedent illness. The concomitant illness may not be identifiable. HHS has also been reported in patients with type I DM, in whom DKA is more common **(Trence, 2001).**

HHS usually presents in older patients with type II DM and carries a higher mortality than DKA, estimated at approximately 10-20%. HHS is characterized by

hyperglycemia, hyperosmolarity, and dehydration without significant ketoacidosis. Most patients present with severe dehydration and focal or global neurologic deficits in as many as one third of cases, the clinical features of HHS and DKA overlap and are observed simultaneously (overlap cases); this suggests that these two states of uncontrolled DM differ only with respect to the magnitude of dehydration and the severity of acidosis **(Kitabchi et al., 2001).**

In older age, the presence of concurrent illnesses, and severity of the metabolic derangements (especially dehydration) contribute to this high mortality. Also, delay in establishing the diagnosis and failure to treat HHS aggressively from the outset may contribute to this high mortality rate **(Nugent, 2005).**

In children, mortality from HHS also appears to be higher than mortality from DKA, but too few cases have been reported to allow accurate statistics **(Trence, 2000).**

Aim of the Work

This study is a trial for rapid identification, and finding new lines to prevent and treat Hyperosmolar hyperglycemic non ketotic states.

Pathophysiology and Complications of Diabetes Mellitus

Pathophysiology of Diabetes Mellitus

The term diabetes mellitus describes several diseases of abnormal carbohydrate metabolism that are characterized by hyperglycemia. It is associated with a relative or absolute impairment in insulin secretion, along with varying degrees of peripheral resistance to the action of insulin. Every few years, the diabetes community revaluates the current recommendations for the classification, diagnosis, and screening of diabetes, reflecting new information from research and clinical practice **(Genuth et al., 2003).**

Diabetes mellitus is a disorder that affects the body's ability to make or use insulin. Insulin is a hormone produced in the pancreas that helps transport glucose (blood sugar) from the bloodstream into the cells so they can break it down and use it for fuel. People cannot live without insulin **(ADA, 2007).**

Diabetes results in abnormal levels of glucose in the bloodstream. This can cause severe short-term and longterm consequences ranging from brain damage to amputations and heart disease **(ADA, 2007).**

The American Diabetes Association (ADA) issued diagnostic criteria for diabetes mellitus in 1997, with follow-up in 2003 and 2010 that The diagnosis is based on one of four abnormalities: hemoglobin A1C (A1C), fasting plasma glucose (FPG), random elevated glucose with symptoms, or abnormal oral glucose tolerance test (OGTT). Patients with impaired fasting glucose (IFG) and/or impaired glucose tolerance (IGT) are referred to as having increased risk for diabetes **(Alberti and Zimmet, 1998).**

The 1997 American Diabetes Association (ADA) Expert Committee introduced the terms type one and type two diabetes and recommended against terms like insulin-dependent and non-insulin-dependent and juvenile-onset and maturity-onset and adult-onset diabetes. In addition to type 1 and type 2 diabetes, "specific types" of diabetes are identified: gestational diabetes, and diabetes secondary to recognized genetic defects and diseases of the exocrine pancreas and other endocrinopathies and or to drugs. This change was also an attempt to classify diabetes according to etiologic differences rather than descriptions based upon age at onset or type of treatment **(Levitzki et al., 2008).**

The diagnosis of diabetes mellitus is easily established when a patient presents with classic symptoms of hyperglycemia (thirst, polyuria, weight loss, blurry vision) and has a random blood glucose value of 200 mg/dL (11.1 mmol/L)

or higher, and confirmed on another occasion. Other diagnostic criteria have been developed based upon the observed association between glucose levels and the risk for developing retinopathy. Fasting plasma glucose values ≥126 mg/dL (7.0 mmol/L), two-hour post oral glucose challenge values of ≥200 mg/dL (11.1 mmol/L), and A1C values ≥6.5 percent are associated with an increased prevalence of retinopathy. The diagnosis of diabetes in an asymptomatic individual can be established with any of the above criteria, as described below. An abnormal result should be confirmed by repeat measurement with the same test **(Cheng et al., 2009).**

The National Diabetes Data Group (NDDG) in the United States and World Health Organization (WHO) established diagnostic criteria in 1979 for normal glucose tolerance and diabetes based upon an oral glucose tolerance test (OGTT). They had also suggested that a category between normality and diabetes should be used, called impaired glucose tolerance (IGT) because subjects with IGT are at increased risk of developing overt diabetes and atherosclerotic vascular disease, even if they do not develop diabetes **(Massin et al., 2011).**

The original WHO criteria defined diabetes as a fasting glucose ≥140 mg/dL (7.8 mmol/L) or a two-hour glucose ≥200 mg/dL (11.1 mmol/L), IGT as fasting glucose <140 (7.8 mmol/L), and a two-hour glucose ≥140 mg/dL (7.8 mmol/L)

but <200 mg/dL (11.05 mmol/L). In 1998, the cutoff value for fasting glucose for diagnosing diabetes or IGT was lowered to 126 mg/dL (7.0 mmol/L) to reflect the 1997 ADA criteria **(Alberti and Zimmet, 1998).**

The WHO concluded that an A1C value of ≥6.5 percent (48 mmol/mol) can be used as a diagnostic test for diabetes. A value of <6.5 percent does not exclude diabetes diagnosed using glucose levels **(Qiao et al., 2002).**

ADA screening recommendations in 1997 strongly emphasized the use of fasting blood levels (no caloric intake for at least eight hours) for diagnosing diabetes and recommended against using the OGTT, which is more troublesome to perform and less reproducible **(Riccardi et al., 1999).**

The WHO agreed with the new definitions, but suggested continued use of the two-hour value on the OGTT for patients with blood glucose values in the "uncertain range" **(Alberti and Zimmet, 1998).**

The ADA follow-up report in 2003 was not as negative regarding use of the OGTT, also noting that both the fasting glucose and 75 gram glucose tolerance tests were suitable for diagnosing diabetes **(Carson et al., 2010).**

In 2001 An International Expert Committee recommended using a hemoglobin A1C value of ≥ 6.5 percent

(≥48 mmol /mol) to diagnose diabetes and the (ADA) affirmed the decision **(Genuth et al., 2003).**

The shift from using the FPG to using A1C to diagnose diabetes may decrease the proportion of patients identified as having diabetes. As an example, in a study of 6890 adults without a history of diabetes participating in the National Health and Nutrition Examination Survey (1999 to 2006), the prevalence of diabetes using A1C versus fasting glucose criteria was 2.3 versus 3.6 percent. Overall, the A1C and FPG criteria resulted in the same classification for 98 percent of the population studied **(Carson, 2010).**

In the absence of unequivocal symptomatic hyperglycemia, the diagnosis of diabetes must be confirmed on a subsequent day by repeat measurement, repeating the same test for confirmation. However, if two different tests (e.g., FPG and A1C) are available and are concordant for the diagnosis of diabetes, additional testing is not needed. If two different tests are discordant, the test that is diagnostic of diabetes should be repeated to confirm the diagnosis **(Cowie et al., 2010).**

The importance of confirming the diagnosis by repeat measurement on a subsequent day, especially when the diagnosis is based upon glucose measurements, is illustrated by a report from the National Health and Nutrition Examination Survey (NHANES) III Second Examination. The prevalence of

diabetes based upon either fasting glucose or two-hour post OGTT glucose significantly decreased when the diagnosis was contingent upon having two abnormal measurements rather than a single abnormal measurement **(Selvin et al., 2007).**

- ## Causes of diabetes mellitus (DM):

The root causes of diabetes are complex. Most cases begin with one of two processes:

A) Metabolic:

Unhealthy lifestyle factors such as overeating, physical inactivity and obesity can impair the body's ability to use insulin. This is called insulin resistance. Uncontrollable risk factors including genetics, family history and age can also be involved **(Genuth et al., 2003).**

Metabolic forms of diabetes include:

a) Type 2 diabetes:

This accounts for 90 - 95% of diabetic cases, according to the U.S. National Institutes of Health (NIH). Some of these patients have had prediabetes that went uncontrolled. Once considered a disease of middle and old age, type 2 is also becoming more common in youths as the incidence of childhood obesity grows.