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ACUTE COMPLICATIONS AND SIGNIFICANT LONG - TERM EFFECTS ASSOCIATED WITH CRITICAL STATUS IN DIABETES MELLITES

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ABSTRACT

With the reduction in mortality rates linked to vascular diseases, which previously accounted for over 50% of fatalities among individuals with diabetes mellitus, cancer and dementia have emerged as the primary causes of death in diabetics in certain regions. Although the impact of traditional complications related to diabetes is still significant, the incidence of these conditions is decreasing due to advancements in diabetes management. Diabetes mellitus is associated with a variety of both acute and chronic complications. This study aimed to evaluate the acute complications of diabetes and their predictors in adult diabetes patients at Jimma Medical Center (JMC) in southwest Ethiopia. The lifetime prevalence of major depression was similar among females (11 out of 48 [22.9%]) and males (seven out of 27 [25.9%]) with diabetes, with both rates significantly exceeding those found in first-degree relatives and the general population. Type 2 diabetes is currently acknowledged as the most rapidly expanding chronic illness in Australia and other Western nations. In developed countries, diabetes is a predominant cause of cardiovascular diseases and kidney failure, particularly in individuals over the age of 60. Epidemiological research has shown that a 1% decrease in HbA1c levels can result in a 15–21% reduction in diabetes-related mortality and a 33–41% reduction in microvascular complications over a decade. This suggests that enhancing glycemic control may have the potential to lower the acute healthcare expenses related to diabetes management.

KEY POINTS : Diabetic ketoacidosis, differential diagnosis, Microvascular complications ,Laboratory Findings , morbidity & mortality

SCOPE OF THE STUDY

The primary acute complications identified were infections (54.4%), followed by abnormal blood glucose levels or related metabolic issues (22.3%) and myocardial infarction or transient coronary artery ischemia (7.6%). The predominant chronic complications included endocrine or metabolic disorders (20.9%), cardiovascular issues (19.7%), neurological symptoms (16.5%), along with renal (14.0%) and ophthalmic (5.2%) complications. Chronic complications were recorded after the diagnosis of diabetes, which might lead to underestimating diabetes-related chronic complications identified prior to or upon diabetes diagnosis, along with the disease burden or the evolution of diabetes management and its effect on complications over time. Time allocations were analyzed for diabetes-related visits, other chronic conditions, and acute illnesses during 1,867 consultations involving patients aged 40 years and older. A clinical diagnosis relies on the observation of dehydration combined with elevated capillary glucose levels, with or without the presence of ketones in the urine or plasma. The acute complications of diabetes, which may manifest as diabetic ketoacidosis (DKA) or hyperglycemic hyperosmolar state (HHS), are major causes for hospital admissions globally. In 2010, the worldwide prevalence of diabetes among adults aged 20–79 years was estimated at 6.4%, and this figure is projected to rise to 7.7% by 2030. Cardiac disease encompasses a range of disorders affecting the heart and blood vessels, including coronary artery disease. Diabetic ketoacidosis is a severe and potentially life-threatening complication of diabetes mellitus, characterized by a complete deficiency of insulin. Diabetes Mellitus (DM) is a chronic condition marked by excessively highly levels of glucose in the bloodstream.

1] Hypertension: a serious health issue where blood vessels experience consistently elevated pressure or high blood pressure.

2] Kidney diseases: also referred to as renal diseases, characterized by damage to the kidneys that disrupts their function.

3] Research has shown that diabetes and its related complications are among the leading causes of inpatient admissions, representing approximately 4.4% of all admissions, which leads to about 3.4% to 32.5% of total deaths.

4] The primary goal of these medications is to address the underlying metabolic issues, such as insulin resistance and insufficient insulin production. They should be utilized alongside a suitable diet and lifestyle modifications. Diabetes management is most effective through dietary changes alone and physical activity (non-drug approaches) or a combination of diet with herbal remedies or oral hypoglycemic medications or insulin (medication approaches).

DIABETIC KETOACIDOSIS (DKA) AND HYPEROSMOLAR HYPERGLYCEMIC STATE (HHS) ARE TWO SERIOUS CONDITION :

Acute, life-threatening emergencies can occur due to severe metabolic decompensation. Diabetic Ketoacidosis (DKA) is more frequently seen in individuals with type 1 diabetes (T1DM) and is marked by a deficiency of insulin and the triad consisting of high blood sugar, the presence of ketones in the blood and/or urine, and metabolic acidosis, whereas Hyperglycemic Hyperosmolar State (HHS) mainly affects those with type 2 diabetes (T2DM) and is characterized by extremely high blood sugar levels, hyperosmolality, and significant dehydration. The main

The difference between DKA and HHS Is based on the level of insulin deficiency. DKA occurs due to a significant lack of insulin alongside elevated counter regulatory hormones, such as glucagon, cortisol, epinephrine, and growth hormone, which results in heightened gluconeogenesis, increased glycogenolysis, and reduced uptake of glucose by peripheral tissues. This ongoing hyperglycemia is further exacerbated by increased gluconeogenesis and reduced peripheral glucose utilization. Extreme hyperglycemia causes osmotic diuresis, leading to dehydration. Treatment complications associated with ketoacidosis include hypoglycemia, which is one of the most frequent issues encountered in patients with DKA. Hypokalemia often arises from the intracellular movement of potassium after administering insulin, affecting roughly 55% of DKA patients and 51% of those with HHS. Hypoxemia, and in rare cases non-cardiogenic pulmonary edema, can occur, potentially due to a drop

in colloid osmotic pressure, which can cause pulmonary edema. Acute kidney failure is a prevalent consequence of both DKA and HHS, commonly stemming from severe dehydration caused by osmotic diuresis.

OTHER LABORATORY FINDINGS

Leukocytosis commonly occurs in individuals with DKA or HHS, potentially due to acute stress; however, a white blood cell count exceeding 25,000/μL may suggest an underlying infection and should prompt further examination. In DKA, the anion gap, determined by the formula [Na+] – ([Cl−] + [HCO3−]), is generally elevated (>12 mEq/L), indicating the advancement of ketoacidosis. Nonetheless, various factors like nausea, vomiting, and renal losses can diminish this increase by contributing to The loss of bicarbonate and imbalance of electrolytes can occur, alongside Kussmaul breathing, which leads to respiratory alkalosis and may result in a complex disturbance involving both metabolic and respiratory acid-base imbalances. The patient's initial assessment included data on age, sex, temperature, glucose levels, serum bicarbonate, pH, total leukocyte count, and differential count. The hospital course for patients with DKA was analyzed, with infections confirmed through culture and/or imaging studies. Even in cases where patients were afebrile and seemingly free of infection, baseline admitting laboratory tests were performed, which included a complete blood count and differential, SMA-18, and arterial blood gas measurements.

DIFFERENTIAL DIAGNOSIS: Alcoholic Ketoacidosis: Similar to DKA, it presents with elevated anion gap metabolic acidosis; however, glucose levels are typically normal or low.

2] Starvation Ketoacidosis: Prolonged fasting or malnutrition can induce ketosis and mild acidosis, with blood glucose often remaining normal or low.

3] Lactic Acidosis: Frequently associated with sepsis and dehydration, this condition causes metabolic acidosis without the presence of ketones. It may also occur in patients with renal impairment and those on metformin for diabetes.

4] Toxins: Compounds like methanol and ethylene glycol can result in high anion gap metabolic acidosis.

5] Renal Failure: Both acute and chronic kidney diseases are linked to metabolic acidosis and uremia, potentially mirroring symptoms encountered in DKA as will be discussed later. These conditions can happen in both type 1 and type 2 diabetes mellitus. DKA is marked by elevated blood sugar levels, the production of ketone bodies, and metabolic acidosis

The diagnostic criteria for DKA included : a serum glucose level exceeding 250 mg/dL, a pH of less than 7.3, a bicarbonate concentration below 18 meq/L, and an increase in serum ketones (beta-hydroxybutyrate). Among these, capillary ketonemia (β-OHB >3.0 mmol/L) demonstrated the best performance with a sensitivity of 99.87%, specificity of 92.89%, and a positive predictive value of 92.89% for diagnosing DKA, in contrast to serum ketonemia (sensitivity 90.45%, specificity 88.65%, positive predictive value 87.76%) or ketonuria (sensitivity 89.89%, specificity 52.73%, positive predictive value 41.87%).

TREATMENT:

Fluids: Normal saline 0.9% is the conventional fluid used. In cases of DKA, an infusion of 15-20 ml per kilogram of body weight within the first hour is typically suitable for adults without renal or cardiac issues. As plasma glucose decreases below 250 mg/dL (13.9 mmol/L), it is recommended to add 5–10% dextrose along with the 0.9% sodium chloride to avoid hypoglycemia while insulin is administered to manage ketonemia. Overall, the treatment objectives include reducing osmolality by 3 to 8 mOsmol/kg per hour, limiting sodium reduction to a maximum of 10 mmol/L within 24 hours, and allowing glucose levels to decrease by as much as 5 mmol/L per hour. Current recommendations indicate that 0.9% sodium chloride solution (normal saline) is the preferred fluid for resuscitation during management.

Insulin: When blood glucose drops below 250 mg/dL (13.9 mmol/L), the insulin infusion rate should be reduced to 0.05 units/kg/h. The infusion will continue until the ketoacidosis is resolved, with rate adjustments made based on glucose levels aiming for a target of 200 mg/dL (mmol/L) in newly diagnosed patients, where basal insulin is

initiated at 0.15–0.3 units/kg. Once DKA is resolved and oral intake is sufficient, intravenous insulin can be stopped, and rapid-acting insulin can be resumed with meals or initiated for new diagnoses.

For patients who have not received both IV insulin and subcutaneously administered basal insulin concurrently during treatment, the infusion should be discontinued at least 1 to 2 hours after SC insulin has been given. If the patient has poor oral intake, initiating a variable rate intravenous regular insulin infusion (RII) is beneficial due to its quick (15-minute) onset of action and the ability to adjust dosages in accordance with fluctuating glucose levels.

Bicarbonate: There have been reports of an increased risk of hypokalemia, cerebral edema, and the occurrence of paradoxical central nervous system acidosis associated with bicarbonate treatment; thus, its application is restricted in cases of severe metabolic acidosis. Although the acid-base balance has garnered significant focus because of the possibilities of bicarbonate-based therapy, its application continues to be debated.

Potassium: In cases of hyperaldosteronism, the decrease in potassium levels is frequently obscured by the shift of potassium from inside the cells to the outside space caused by insufficient insulin and the occurrence of acidosis. Present guidelines recommend that the dosage of potassium supplementation be based on the levels of potassium found in the blood.

Phosphate: A decrease in phosphate levels may occur due to an osmotic shift into the extracellular space and renal losses from osmotic diuresis. Guidelines and detailed algorithms are available for the management of DKA. Emergency Departments (EDs) usually serve as the primary location for diagnosis, the start of treatment, and stabilization

MICROVASCULAR COMPLICATIONS :

Microvascular conditions contribute to pathologic and functional changes in multitudinous apkins, including eye, heart, order, skin, and neuronal apkins. These changes are traditionally known as diabetic retinopathy(DR), nephropathy, supplemental neuropathy, and autonomic neuropathy, singly, predicated on the apkins affected. As Medical wisdom advances increasingly Toward prevention of complications of Diabetes, it's important for clinicians To be familiar with the relationship Between diabetes control and vascular Injury. Microvascular conditions contribute to pathologic and functional changes in multitudinous apkins

Diabetic retinopathy Diabetic retinopathy may be the most Common microvascular complication of diabetes. It's responsible for

New cases of blindness every Time Growth factors, including Vascular endothelial growth factor VEGF), growth hormone, and Transforming growth factor beta, Have also been supposed to play Important places in the development Of diabetic retinopathy Background retinopathy includes analogous features as small hemorrhages In the middle layers of the retina. They clinically appear as " blotches " and therefore are constantly appertained to As " fleck hemorrhages. " Presently, oxidative stress, inflammation, neovascularization, neurodegeneration, and neurovascular unit are known to be mechanisms of DR circumstance and development.

• Nonproliferative retinopathy — Microaneu- Rysms and other retinal lesions.

• Proliferative retinopathy — Growth of Abnormal blood vessels and fibrous kerchief

From optic vagrancy- whams head or inner retinal face.

• Macular edema — Fluid leakage from Blood vessels that causes macular

Because photocoagulation surgery is so Effective at preventing vision loss, it's essential and cost effective — that cases with Diabetes should have at least an periodic dilat- Ed eye test by an ophthalmologist orOptometrist.40, 77,82 Recommendations for eye Examinations DR is characterized by abnormalities of the retina and is divided into 2 main ordersnon- proliferative diabetic retinopathy(NPDR) and proliferative diabetic retinopathy this aberrant metabolic condition is reflected by cellular hypoxia, zilches, the accumulation of free revolutionaries, altered metabolic pathways, thrombophilia, and altered platelet physiology and functions These

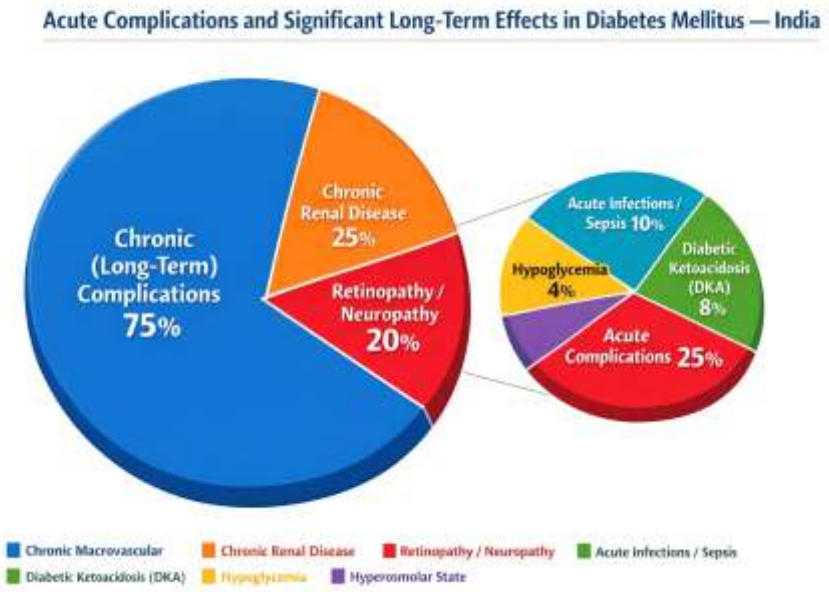
glial cells also serve as the major source of multitudinous factors including inflammatory modulators, which indicates that the activation of retinal glial cells can lead to the onset of the inflammatory medium responsible for retinal injury at after stages of DR.

Diabetic Neuropathy

Diabetic neuropathy(DN) represents a significant microvascular complication associated with diabetes, impacting both supplemental and autonomic jitters. The activation of mitogen- actuated protein kinase(MAPK) and the devilish expression of COX- 2 are also told by TNF- α. These mechanisms are linked to the proinflammatory responses and neuropathic differences caused by diabetes. The IASP taxonomy distinguishes neuropathic pain(NP) from nociceptive and, more recently, nociplastic pain. Nociceptive pain is characterized as " pain performing from the activation of nociceptors innon- neural apkins due to factual or implicit kerchief damage, " whereas nociplastic pain is described as " pain that occurs from changes in nociception without clear suggestions of kerchief damage or any validation of pathology or lesions in the somatosensory system that would explain the pain, " covering nine distinct conditions linked to ongoing or recreating discomfort habitual pain can also arise in neurological conditions with an unidentified cause, analogous as idiopathic neuropathies.

Diabetic Nephropathy

Diabetic nephropathy(DNP), also known as diabetic order complaint, is a microvascular complication of diabetes mellitus(DM) that leads to end- stage renal complaint. Diabetic nephropathy(DN) is the most common diabetes- related complication associated with cardiovascular conditions. Pathophysiology involves the study of the characteristics, causes, and goods of conditions, fastening on the structure and function of the body, particularly the differences in body tissues and organs that affect from or beget complaint. In recent times.



PREGNANCY COMPLICATIONS : Pregnancy didn't appear to directly speed up the pace. Of deterioration of kidney function. In females with diabetes The mortality from perinatal nephropathy can be avoided. However, perinatal and extended infant health issues re-Mains raised Today, the perinatal results of pregnancies affected by diabetic women lacking serious diabetic complications is comparable to that in women without diabetes, Numerous studies have demonstrated that obesity and being overweight prior to pregnancy are distinct risk factors for pregnancy-induced hypertension (PIH) and gestational diabetes mellitus (GDM) .The information we gathered post-pregnancy was sourced from medical files. Data on pregnancy

results included fetal gender, neonatal weight, gestational period at delivery, and intrauterine growth limitation.

CONCLUSIONS : A location for screening for diseases like depression, liver disease, and cancer in diabetes mellitus guidelines should be taken into consideration. Additionally, primary care physicians who are on the front lines of diabetes mellitus care need to be made more aware of emerging complications. To find the best model of care for people with cardiovascular complications in terms of both lowering costs and improving clinical outcomes, more program development and evaluation are required. Because of its direct connection to cardiovascular problems, early and intensive risk factor management is essential.

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