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Estimation of Microalbuminuria in Hearing Loss in Diabetes Mellitus - A Review.

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ABSTRACT

Diabetes mellitus (DM) is a metabolic disorder caused by insulin deficiency, defect in its action or insulin resistance leading to increased sugar in the blood termed hyperglycemia. This in turn affects the lipid, carbohydrate & protein metabolism. Among the endocrine disorder diabetes mellitus is most common in the society. 200 million people was affected by this disease by 2010 and it is expected that 300 million will be affected by the year 2025. In those diabetics whose glycemic status under control, the complications of diabetes mellitus are far less common and less severe. But diabetic complications are more common in those diabetics not under glycemic control. As the disease progresses they will have the complication such as neuropathy, retinopathy, cochleopathy, nephropathy and cardiovascular complications due to tissue and vascular damage. The aim of this article is to tell about the microalbuminuria which is a useful marker of microvascular complication of diabetes mellitus and to create awareness among the diabetic patients about the morbid complication i.e. diabetic cochleopathy leading to sudden irreversible bilateral hearing loss. Henceforth it is mandatory to screen microalbumin in urine for the diabetic people and also to have their glycemic control in good condition so as to prevent from morbid complication i.e. cochleopathy.

Keywords: Diabetes mellitus, Microalbuminuria, Cochleopathy.

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INTRODUCTION

Diabetes mellitus is an endocrinological metabolic disorder due to defect in secretion of hypoglycaemic hormone insulin, its action and its resistance. This is in turn leads to hyperglycemia affecting carbohydrate, protein and lipid metabolism. Diabetic complications like cardiovascular, nephropathy, cochleopathy, retinopathy, ulceration, neuropathy etc [1]. Thus, diabetes leads to a wide range of heterogeneous diseases. Among the morbid complications diabetic cochleopathy leads to irreversible, sudden bilateral hearing loss [2-4]. World Health Organization (WHO) in 1965, put forward the diagnostic criteria and the classification of diabetes, then in1979 by the National Diabetes Data Group followed by simplified recommendations in 1980 by the WHO. Later it was recommended by The American Diabetes Association (ADA) in 1997 and by the WHO in 1999. According to WHO diagnosis and classification of diabetes mellitus (1999), a fasting glucose >126 mg/dl and a 2hr glucose >200 mg/dL should be diagnostic of diabetes mellitus. This should be correlated with clinical symptoms which includes polyuria, polydypsia, and polyphagia., weight loss, fatigue, cramps, constipation, blurred vision, and candidiasis

Diabetes mellitus may be classified into two major types type 1 and type 2, described as IDDM and NIDDM, respectively. On the basis of etiology, type 1 is due to little or no endogenous insulin secretion and require insulin therapy for survival. The causes may be due to immunological destruction of pancreatic ß cells resulting in insulin deficiency, genetic defects in insulin secretion, diseases of the exocrine pancreas endocrinopathies, drug-induced or chemical induced, infections (congenital rubella, cytomegalovirus and others), uncommon forms of immune mediated diabetes, other genetic syndromes associated with diabetes and autoimmunity.

Type 2 diabetes is the commonest form of diabetes and is characterized by disorders of insulin secretion and insulin resistance. The disease affects up to 7% of the population In Western countries. It affects 5-7% of the world's population. Type 2 diabetes is common in the age group of 40. It is usually related with obesity, decreased physical activity and heredity. Diabetes can be controlled with diet, regular exercises, drugs.

Maturity-onset diabetes of the young (MODY) is autosomal-dominant inherited, a familial form of NIDDM develops in adolescence or young adulthood which affects the insulin secretion. Type 1 DM patients are more susceptible to microvascular and macrovascular complications. Most of the type 2 DM cases which is insidious in onset are diagnosed because of complications or incidentally. They have a high risk of large vessel atherosclerosis associated with hyperlipidaemia and obesity, hypertension etc. Mortality rate in diabetics is increased in cardiovascular complications and nephropathy.

Metabolic syndrome includes obesity, hyper-triglyceridemia, low HDL cholesterol, elevated blood pressures, insulin resistance. Metabolic syndrome Can be diagnosed by National Cholesterol Education Programme (NCEP)

- Elevated waist circumference: Men equal to or greater than 40 inches and for women equal to or greater than 35 inches
- Elevated triglycerides: Equal to or greater than 150mg/dl
- Reduced HDL ("good") cholesterol: For men less than 40mg/dl: for women, <50mg/dl
- Elevated fasting glucose: Equal to or greater than 100mg/dl

Complications

Acute complications

- Diabetic keto-acidosis: more common in type-1 diabetes mellitus diagnosed by the presence of ketone bodies in the urine (ketonuria) is detected by Rothera's test. ketone bodies lowera the plasma pH, leading to metabolic acidosis called diabetic keto-acidosis.
- Hyperosmolar nonketotic coma: Elevation of glucose to very high levels (900mg/dl or more). would increase the osmolality of extracellular fluid (ECF). Osmotic diuresis leads to water and electrolyte depletion leading to the coma due to hypertonicity of ECF.

Chronic complications

- Vascular Diseases: Atherosclerosis in vessels leads to plaque formation, intravascular thrombosis leading to paralysis. myocardial infarction, retinopathy, cochleopathy and nephropathy.
- Complications in Eyes: cataract due to increased rate of sorbitol formation, retinopathy and blindness.
- Neuropathy: Periperal neuropathy with paresthesia, foot ulcers and gangrene.

Causes of Diabetic cochleopathy

- Microangiopathy of the inner ear.
- Neuropathy of the cochlear nerve.
- Combination of both.
- Outer hair cell dysfunction
- Disruption of endolymphatic potential.

Microangiopathy of the inner ear may be due to edematous changes of the intermediate cells and atrophy of marginal cells in the stria vascularis and thickening of the basement membranes of capillaries [5,6]. Actiation of polyol pathway in the hyperglycemic state leads to angiopathic change in the stria vascularis with impairment of blood flow caused by microangiopathy cause hypoxia. In addition oxidative stress as a result of activation of the polyol pathway in the hyperglycemic state causing atrophy of stria vascularis [7-9]. Diabetic induced apoptotic cell loss may also occur in the stria vascularis [10].

So microalbuminuria is considered an important indicator of diabetic cochleopathy due to micro-angiopathy Microalbuminuria is when the level of the protein albumin in the urine is always slightly elevated [30-300mg of albumin being lost in urine / day]. It is a predictor of progressive renal damage and small vessels damage (micro-angiopathy) causing cochleopathy. Albumin more than 300 mg/day indicates overt diabetic nephropathy.

Microalbumin

Blood contains cells and proteins that we need, as well as waste products that our body needs to get rid of. Blood is filtered by kidneys and waste products are removed from the body in the urine.

Usually cells and proteins stay in blood, but sometimes a small amount of protein is lost along with other waste products.

Diagnostic importance

- Sign of more widesspread damage to the blood vessels including inner ear.
- Development of microalbuminuria has been linked to diabetes leading to sensori-neural hearing loss.

Micro-albuminuria is to be checked at least once in a year.

Estimation of microalbumin

Quantitative estimation of Microalbumin (MAL) in human urine by turbidimetric immunoassay

Reagents Provided

R1

- Phosphate buffered saline (pH 7.43)
- Polyethylene glycol (60 g/L).
- Sodium azide (0.95 g/L).

R2

- Phosphate buffered saline (pH 7.430.
- Polyclonal goat anti-humanAlbumin (variable0.
- Sodium azide (0.95g/L).

Stability and storage

The reagents are stableuntil expiry date when kept at 2-8°c. Stability in the instrument is atleast 4 weeks if contamination is avoided. Do not freeze.

Warnings and precautions

- The Microalbumin reagents are intended for in vitro diagnostic use only.
- Sodium azide has been reported to form lead or copper azide in the laboratory plumbing which may explode on percussion. Flush drains with water thoroughly after disposing of fluids containing sodium azide.
- The polymer enhancer (polyethelene glycol) is non biohazardous.
- Each donor unit used in the preparation of the standards and controls was found to be negativefor the presence of HIV1 and HIV2 antibodies, as well as for the hepatitis B surface antigen and anti-hepatitis C antibodies, using the method approved by the FDA.

Specimen

Collect random mid-stream urine sample. If the test cannot be carried out on the same day, the urine may be stored at 2-8°C for 48 hours.

Assay procedure

Wavelength	340nm
Optical path	1 cm
Temperature	37°C
Measurement	Against reagent blank

	Blank	sample or standard
Sample or Standard		30 µl
Reagent1	900µl	900 µl

Mix, read absorbance A1, then add:

Reagent2	100 µl	100 µl

Mix, incubate for 5 minutes at room temperature then read the absorbance A2.

Calculate Absorbances, plot a standard curve and read the concentration of controls and samples.
Reference value

Normal 30-300mg/dl.

SUMMARY

Diabetic cochleopathy, diabetic retinopathy can be predicted by microalbumin in urine (small excretion of albumin in urine i.e. 30- 300mg/dl).

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CONCLUSION

From this study it is cocluded that microangiopathy is one of the causative factor of diabetic cochleopathy leading to hearing impairment. Microalbumin being a prognostic factor of this morbid diabetic complication, it is mandatory to screen the diabetics not under glycemic control, so as to prevent from them from irreversible hearing loss.

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