GINGIVAL VASCULAR BASEMENT MEMBRANE CHANGES IN DIABETES MELLITUS

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Abstract

Diabetes mellitus is a heterogenous primary disorder of carbohydrate metabolism with multiple etiological factors leading to persistent hyperglycaemia. The gingival vascular bed mirrors rather accurately the general state of the patients. The present study clearly shows the increased incidence of basement membrane changes in diabetics. This study was carried out which could make the PAS staining, a routine method to study the thickening of blood vessels for evaluation of underlying diabetic conditions in routine biopsy specimen.

Introduction

Diabetes mellitus represents one of the major chronic health problems facing the world today. Although ranked twenty-seventh at the beginning of this century, as the cause of death, it now stands next to cancer and cardio-renal vascular diseases. It is, because of its frequency, probably the most important metabolic disease affecting the cellular biochemical process within the body.

Diabetes mellitus is a heterogenous primary disorder of carbohydrate metabolism with multiple etiological factors that generally involve absolute or relative insulin deficiency or insulin resistance or both, ultimately this leads to persistent hyperglycaemia which is the hallmark of this disease.

The classic signs and symptoms of diabetes mellitus include the triad of frequent urination (polyuria), increased thirst (polydypsia) and increased hunger (polyphagia) together with pruritis, weakness and fatigue.

It is said that gingival vascular bed mirrors rather accurately the general state of the patients. Russel[12] found statistically significant abnormalities in a study of gingival tissue from Diabetes Mellitus. Particularly striking were the PAS positive diastase resistant thickening of the

vessel walls and the swelling and proliferation of endothelial cells which in many cases produced luminal obliteration.

Dentist is the first person to suspect or diagnose patients having diabetes mellitus is a definite possibility. In view of these findings it was deemed important that a study should be carried out which could make the PAS staining, a routine method to study the thickening of blood vessels for evaluation of underlying diabetic conditions in routine biopsy specimen. This could seriously modify the routine procedures carried out in dentistry.

Classification

I. Primary Diabetes Mellitus

1) Type I – Insulin Dependent Diabetes Mellitus (IDDM)

2) Type II – Non Insulin Dependent Diabetes Mellitus (NIDDM)

a) Non Obese NIDDM

b) Obese NIDDM

c) Maturity Onset Diabetes mellitus of Young (MODY)

II. Secondary Diabetes Mellitus

1) Diabetes due to pancreatic disease

a) Chronic or recurrent pancreatitis

b) Haemochromatosis

II) Diabetes due to other endocrine diseases

a) Cushing's syndrome

b) Acromegaly

c) Hyperaldosteronism

d) Phaeochromocytoma

e) Thyrotoxicosis

f) Glucagonoma

III) Diabetes due to drugs and toxins

a) Glucocorticoids and ACTH

b) Diuretics

c) Phenytoin

d) Pentamidine

IV) Diabetes due to abnormalities of insulin or its receptor

a) Insulinopathies

b) Receptor defects

c) Circulating antireceptor antibodies

V) Diabetes associated with genetic syndromes

a) DIDMOAD syndrome

b) Myotonic dystrophy

c) Lipoatrophy

d) Type I glycogen storage diseases

e) Cystic fibrosis

VI) Malnutrition Related Diabetes Mellitus (MRDM)

VII) Gestational Diabetes Mellitus (GDM)

III) Impaired Glucose Tolerance (IGT)

a) Non obese

b) Obese

c) Associated with certain conditions and syndromes

Oral Manifestations

The characteristic oral manifestation of diabetes is not mentioned in the literature[2]. But patient with uncontrolled diabetes showed increase in the severity of periodontal diseases and caries index. Some authors suggested that poor oral hygiene and xerostomia in DM is primarily responsible for the development of the periodontal diseases.

Xerostomia is a commonly reported symptom in diabetic patients. Sialosis (non inflammatory, non neoplastic, bilateral enlargement of parotid glands) is also seen in DM. Glossodynia and Median rhomboid glossitis are also reported in diabetes.

Tissue Level changes in Diabetes Mellitus

Histological studies have demonstrated that gingival blood vessels in subjects with long term diabetes mellitus have more atherosclerosis with occlusion of the smaller blood vessels than do those of non-diabetic controls.

Hove and Stallard[8] found out thickening of basement membrane of blood vessels in diabetic subjects when compared to those of non diabetic controls in their light microscopic study. Clinical[4] studies have demonstrated that diabetes mellitus of long term duration and poor metabolic control shows clearly higher levels of gingival inflammation and periodontal diseases than non diabetic control subjects.

In diabetics the periodontium[9, 11, 12] is probably affected by increased collagenase action, functional abnormalities of neutrophil degranulation as a source of gingival crevicular fluid collagenase or other metabolic abnormalities in periodontal ligament fibroblast. Vascular changes in properly controlled long term diabetes shows microangiopathy.

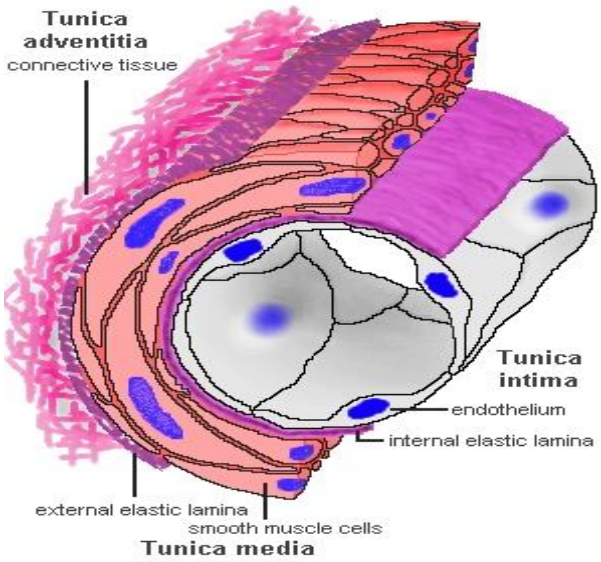
Basement Membrane Changes

Normal Structure

On light microscopy capillary basement membrane is an amorphous sheath which encloses the capillary cells. Electron microscopy reveals a fibrillary structure with inner and outer clear zones (lamina lucida and lamina externa) and an intermediate lamina densa.[8]

Type IV collagen is the most abundant protein found in capillary basement membrane. Other constituents include proteoglycans, heparin, chondroitin and dermatin sulphates and glycoprotiens such a laminin, fibronectin and entactin.

Basement membrane[1] act as a structural support for vessel walls preventing overdistention under normal condition and forming scaffolding during endothelial cell repair and regeneration.



Several constituents of capillary basement membrane are chemically modified in DM. RAY is outlined thickening and hyalinization[6,7] of blood vessels in diabetics. This may cause swelling and proliferation of endothelial cells leading to luminal obliteration.[10]

Thickening of basement membrane in DM.[3]

Aims and Objectives of the study

1. To study the changes in gingival vascular basement membrane with serum and salivary glucose levels.
2. To correlate the changes of basement membrane with serum and salivary glucose levels**.**

Materials & Methods

Patients were selected with a positive history of DM from different age groups. The gingival biopsy was taken from inter dental papilla of a tooth distal to second premolar. The specimen was fixed in formalin and immediately transported to laboratory. Histological sections were cut at a thickness of 5 microns, processed and stained with hematoxylin and eosin, PAS and viewed under light microscope.

Results

TABLE 1

PT No.	***Serum Glucose***	***Basement Membrane Changes***
1	110	+
2	102	+ +
3	106	+ +
4	120	+ + +
5	113	+
6	124	+
7	108	+
8	122	+
9	128	+ +
10	119	+
11	106	+
12	96	+
13	115	+
14	94	+ +
15	107	+
16	126	+
17	113	+
18	116	+ +
19	110	+ + +
20	120	+

+ = Mild	+++ = Severe
++ = Moderate	+ = Suspicious

TABLE 2

PT No.	*Intensity of Stain*	*Increased width of BM*	*Duplication of BM*	*Swollen Endothelium*
1	-	-	-	+
2	+	+	+	+
3	+	+	+	+
4	+	+ + / +	+	+
5	+	+	-	-
6	-	-	-	+
7	+	+	+	-
8	-	+	-	+
9	+	+	+	+
10	+	-	-	-
11	-	+	-	+
12	+	-	-	+
13	-	+	-	+
14	+	+	+	+
15	-	+	-	+
16	+	-	-	-
17	-	+	-	+
18	+	+	+	+
19	+	+	+	+ +
20	+	+	-	-

+ = Mild	+++ = Severe
++ = Moderate	+/ - = Suspicious

Discussion

The present study clearly showed the increased incidence of basement membrane changes in diabetics. It also showed that there is a constant change in basement membrane in relation to intensity of stain, increase width of

basement membrane, duplication of basement membrane or irregularities as well as swollen endothelial cells. These results were obtained by PAS and Diastase staining. Four parameters were mentioned in basement membrane changes. These parameters were related to both structural and functional changes which is seen in microangiopathies.[10] Structural changes includes thickening of basement membrane where as functional changes include increased intravascular pressure and enhanced vascular leaking. Both this changes either act singly or in combination.

Of the functional changes, increased blood flow, vascular permeability and rheological control are important. Increased capillary permeability can be demonstrated in diabetes of short duration long before any structural changes are evident. Pre capillary resistance is reduced which increases the flow through the capillary belt. This results in a greater tangential stress on the endothelial cells. This will also change endothelial charge characteristic leading to increased permeability. This creates duplication and irregularities in the endothelium and basement membrane which can be seen under microscope.

Conclusion

Diabetes mellitus is a disease that has the history of ages but still it is a enigma as far as its complications and treatments[5] are concerned. This study clearly showed that arteriosclerosis is increased in a diabetic patient. A long term study using large numbers of patients including both controlled and uncontrolled diabetics is suggested for the detailed evaluation.

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