INTRODUCTION

The eye is the window through which the brain perceives the world around. The retina, a thin sheet of tissue that lines the orbit of the eye, converts light into the nerve signals that the brain interprets as visual images. This tiny outpost of the central nervous system must extract all the essential features of the visual scene rapidly and reliably under specific conditions. The retina’s ability to perform these tasks outstrips that of the most powerful supercomputers.

With the widespread use of insulin and the substantially increased survival of individuals with diabetes, the late complications of the disease became increasingly prominent, including diabetic retinopathy, diabetic nephropathy, diabetic neuropathy and also diabetic large vessel disease with increased risk of myocardial infarction, stroke and vascular disease of the lower extremities with development of non-healing ulcers and gangrene (Frank, 1995).

Diabetic retinopathy (DR) was first described over 100 years ago. However, it was not studied intensively until much later, the discovery of insulin in the early 1920s. This is because the long duration of diabetes required for the early manifestation of the ocular disorder. Diabetic retinopathy is the major preventable cause of blindness in the population above 45 years of age. Twenty per cent incidence of blindness in the 45 plus age group is due to diabetic retinopathy in the West. In India, age-related cataract is the major cause of blindness. But that
doesn't mean the burden of DR is not rising. DR is a slow process, it takes many years to develop.

Duration of diabetes is a factor in the development of DR (Klein et al., 1984a). As the duration of insulin dependent diabetes mellitus (IDDM) increases from 7 to 20 years, the diabetic retinopathy also increases from 50 to 90%. During the first 5 years of IDDM, DR rarely develops. (Klein et al., 1984a and 1984b). The natural history of non-insulin dependent diabetes mellitus (NIDDM) is harder to describe since NIDDM may be present for many years before diagnosis. As a result, the patients with NIDDM may develop severe diabetic retinopathy by the time of diagnosis NIDDM (Klein et al., 1984c).

It has recently been estimated that nearly 2 million people in US each year suffer from blindness due to retinal diseases, the pathogenesis of which is only partially understood. Thus, morphological, physiological, pharmacological, biochemical and molecular biological approaches have been applied to obtain a better understanding of the cellular and molecular retinal events affecting the diseases.

The anatomy of the lesions seen in diabetic retinopathy lies in the microvasculature of the retina. Anatomically, there are ten layers of the retina and some of them are particularly important to the understanding of retinal disease states (Wu, 1995). The layers are from inside the vitreous going more posteriorly (Figure 1.1) – (a) retinal pigment epithelium; (b) rods and cones; (c) external limiting membrane; (d) outer nuclear layer; (e) outer plexiform layer; (f) inner nuclear layer; (g) inner plexiform layer; (h) ganglion cell layer; (i) nerve fibre layer and (j) internal limiting membrane. In addition, external to the retinal pigment epithelium is Bruch’s membrane and going outwardly, the layers are choriocapillaris, choroid, suprachoroid and sclera (Wu, 1995).
The pathogenesis of DR is not fully understood. The loss of pericytes is thought to cause microaneurysm formation and early leakage of blood and blood products. The leakage of blood product is a source of focal retinal edema and hard exudate rings seen in diabetic macular edema. Retinal arteriolar obstruction results
in ischaemic nerve fibre layer infarcts, or better known as cotton wool spots or soft exudates. Large, dark blot haemorrhages are haemorrhage infarcts. The arteriolar obstruction leads to venous stasis and the appearance of venous beading. White thread-like arterioles are signs of arteriolar obstruction. It is this stage that may play a role in ischaemia and acts as a stimulus to neovascularisation.

The presence of the vessels marks the beginning of the most severe stage of diabetic retinopathy—proliferative diabetic retinopathy. Abnormal new vessels are made with abnormal vessel walls, prone to leakage of blood and blood products. The bleeding adjacent to the vitreous interface causes fibrovasculature contracture and the formation of traction retinal detachments. Later on, vitreous haemorrhage combined with retinal detachment may lead to poor visual prognosis.

Aim

It is observed that the control of glycaemia does not prevent the emergence of diabetic retinopathy. This stimulated interest in some new biochemical rationalisation and radically different prospective therapeutic measures. The challenge in diabetic research now is to identify factors underlying the link between periodic imbalance of glucose metabolism and the pathogenesis of diabetic complications. In this circumstance, the present investigation has been carried out to explain the possible mechanisms involved in the formation of DR with the help of biochemical changes seen in the blood in comparison to diabetes without retinopathy and normal control.

Hyperglycaemia was assessed by investigating the levels of glycosylated haemoglobin (HbA1c). The effect of free radical damage in the diabetic retinopathy was studied by estimating the levels of lipid peroxidation, such as malondialdehyde (MDA) and diene conjugates (DC).
The role of hexose monophosphate shunt enzymes in the development of retinopathy were carried out by measuring the activity of glucose-6-phosphate dehydrogenase (G-6-PD), 6-phosphogluconate dehydrogenase (6-PGD), transketolase (TK) and transaldolase (TA) of red blood cells.

Glutathione linked enzyme system and diabetic retinopathy were studied by investigating the activity of glutathione reductase (GR), glutathione transferase (GST), glutathione peroxidase (GSH-Px) and levels of reduced glutathione (GSH). Further, a detailed study of the antioxidant status in diabetic retinopathy was studied by estimating the activity of superoxide dismutase (SOD) and catalase.