REVIEW OF LITERATURE
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Diabetes mellitus is a panmetabolic disorder. Even after recession of diabetic coma and of infection as a cause of death since the discovery of insulin, its cardiovascular complications still remains the most important consequence of diabetes mellitus. Its vascular complications are still alleged to be the major causes of morbidity and mortality among diabetics.

Bryfogle and Bradley (1957) reported that at least one of the vascular complications was found in 49.5% diabetics (195 out of 394) and in almost half of the cases more than one type of complication existed. Lewis and Symons (1958) and Singh Verma et al. (1979) reported 42.5% and 46.0% incidence of vascular complications respectively.

The higher incidence of cardiovascular complications with advancing age of the patient has been observed by Bradley (1959), Mukharjee (1971), Vaishnav and Bhasin (1974), Singh Verma et al. (1979).

Sex - The vascular complications are more frequently observed in male diabetics than female diabetics (Pathania and Sachar, 1961, Mukharjee, 1971, Singh Verma et al 1979).
Duration - The incidence of vascular complications seems to be directly related to duration of diabetes. Bryfogle and Bradley (1957) reported that at least one of the complication was found in 87.5% of diabetics after 10 or more years of diabetes. Singh verma et al (1979) observed cardiovascular complications in 30.2%, 31.25% and 80.9% diabetics having diabetes for less than 5 year, 6-9 years and 10 years or above respectively. Increase in incidence of cardiovascular complications has been reported by Lewis and Symons (1958) and Nigam et al (1980) also.

Serum Cholesterol - Mukharjee (1971) observed increase in incidence of cardiovascular complications with increasing levels of serum cholesterol in diabetics. Suri et al (1979) observed significantly high serum cholesterol levels in diabetics with cardiovascular complications (240 mg%) in comparison to control group (214 mg%). But there was no significant difference from the levels of serum cholesterol of diabetics without cardiovascular complications. Similarly Sinha and Ghosh (1960), Mukharjee (1971), Amini et al (1976) and Singh verma et al (1979) observed raised levels of cholesterol in diabetics with cardiovascular complications, in comparison to control group and diabetics without cardiovascular complications.

Lipoproteins - Sinha and Ghosh (1960) observed increase in beta lipoprotein in diabetics with cardiovascular compli-
cations as compared to healthy control group. Amini et al (1976) reported type IIa hyperlipoproteinaemia (50%) as commonest abnormality among diabetics with cardiovascular complications. Srivastava et al (1979) observed hyperlipoproteinaemia in 70.0% diabetics with cardiovascular complications and type IIa hyperlipoproteinaemia was commonest abnormality detected. In contrary, Suri et al (1979) observed type IV hyperlipoproteinaemia predominantly among diabetics with cardiovascular complications.

**Cardiac involvement** - The increased frequency and prematurity of ischaemic heart disease among diabetics in comparison to general population has been well established by clinical and autopsy reports in field survey by Sarvotham and Berry (1968), the incidence of ischaemic heart disease was 6.5% in general population as evident by resting electrocardiogram. Clawson and Bell (1949) in a review of 50,000 autopsies found fatal coronary disease about twice as frequent in males and three times as frequent in females with diabetes in comparison to non-diabetics. The incidence of cardiac involvement in the form of atherosclerotic heart disease ranges from 40-77% in western literature. The incidence is 42% as reported by Liebow et al (1955), 40.1% by Bryfogle and Bradley (1957), 77% by Anderson et al (1961), 45.0% by Cohen et al (1963). Lesser incidence has been reported by Lewis and Symons (1958) 10.3%. Incidence of atherosclerotic heart disease among Indian diabetics has been reported to be
35.0% by Banarjee (1966), 56.7% by Banarjee and Mukharjee (1967), 60.0% by Mukharjee (1971), 23.96% by Dutta et al (1976). On including diabetics with positive stress test, the incidence of cardiac involvement increased markedly as reported by Vaishnav (1964), the incidence increased to 33.9%.

**Age** — Bryfogle and Bradley (1957), Banarjee and Mukharjee (1967) and Vaishnav et al (1964) reported maximum incidence of cardiac involvement in 7th and 8th decades. Mukharjee (1971) observed the incidence of cardiac involvement to be 50% and 60% in age group of 60-69 years and 70-79 years respectively. Lundbaek et al (1954), Liebow et al (1977), Bradley and Bryfogle (1956) and Agarwal et al (1977) observed that in comparison to male, female diabetics had cardiac involvement more frequently. In contrary, Pathania and Sachar (1961) reported cardiac involvement to be 1.7 times more frequent in males than females (24.8% and 14.6% respectively). Similar observations were made by Mukharjee (1971), Dutta et al (1976) and Nigam et al (1977).

Ischaemic heart disease was observed in 66% diabetics by Lundbaek (1954), 42% case by Liebow et al (1955), in 40.0% cases by Bradley and Bryfogle (1956), in 21.7% cases by Pathania and Sachar (1961), in 25.1% case by Lal and Bahl (1957), in 70.9% cases by Banarjee and Mukharjee (1971), in 9.21% by Vaishnav (1974), 13.9% cases by Dutta et al (1976), 29.1% cases by Nigam et al (1977), 39.7% cases by Agarwal et al (1977), 38.7% by Ghatiy et al (1979) and in 15% diabetics by Singh Verma et al (1979).
Angina pectoris was observed in 9.1% cases by Bryfogle and Bradley (1957), in 11.6% cases by Lewis and Symons (1958), in 7% cases by Mukharjee (1971), 10.52% cases by Dutta et al (1976), in 29.0% cases by Nigam et al (1977), and 35.0% case by Chetty et al (1978).

Myocardial infarction was observed in 6.8% case by Liebow et al (1955), in 8.6% cases by Bryfogle and Bradley (1957), 7.6% cases by Lewis and Symons (1958) in 3.67% case by Dutta et al (1976), in 5.87% cases by Nigam et al (1977) and 4.0% case by Chetty et al (1978).

Age - Dutta et al (1976) reported highest incidence of ischaemic heart disease in 5th and 6th decades. Nigam et al (1977) observed maximum incidence of ischaemic heart disease in 41–60 years of age (65.7%). Agarwal et al (1977) reported that majority of diabetics with ischaemic heart disease (76.2%) were in 50–70 years age group. Chetty et al (1978) also observed increased incidence of ischaemic heart disease in diabetics of advanced age group. The incidence of ischaemic heart disease among diabetics of 40 years or above and 50 years or above were observed in 44.6% and 48.4% diabetics by Mukharjee (1971), 39.4% and 43.8% by Banarjee (1966) and in 56.2% and 66.4% cases by Bryfogle and Bradley (1957) respectively.

reported that female develop ischaemic heart disease more frequently than male diabetics. In contrast, Pathania and Bachar (1961), Banarjee (1966), Malhotra and Behl (1968), Mukharjee (1971), Dutta (1976) and Nigam et al (1977) observed a male predominance. Freedome from coronary artery disease is significantly reversed in diabetic females.

**Duration of diabetes** - Pathania and Sachar (1961) observed that 71% of diabetics with ischaemic heart disease were having duration of diabetes more than 5 years and observed increasing incidence of ischaemic heart disease with increasing duration of diabetes. Bryfogle and Bradley (1957), Pathania and Sachar (1961), Mukharjee (1971), Banarjee (1966), Nigam et al (1977) and Chetty et al (1977) also observed and positive correlation between incidence of ischaemic heart disease and duration of diabetes.

**Serum Cholesterol** - Ahuja et al (1969), Gossain and Ahuja (1967) and Lowy and Barach (1957) observed elevated cholesterol values in diabetics with ischaemic heart disease. Patney et al (1979) observed the mean cholesterol in diabetics with ischaemic heart disease to be 227 mg% and values were significantly higher than control group. Similar results have been reported by Suri et al (1979).

**Lipoproteins** - Lowy and Barach (1957) observed elevated beta lipoprotein in diabetics with ischaemic heart disease. Patney et al (1979) and Gupta et al (1979) observed type IIa hyperlipoproteinaemia as commonest abnormality among
diabetics with ischaemic heart disease. But Enger and Ritaland (1970) observed a higher frequency of type IV hyperlipoproteinaemia among diabetics with ischaemic heart disease.

Associated complications with cardiac involvement - The incidence of associated hypertension among diabetics having ischaemic heart disease has been observed to be 40.8% by Pathania and Sachar (1961), 23.9% by Vaishnav et al (1964), 62.9% by Banarjee (1966), 50.6% by Dutta et al (1976), 45.6% by Nigam et al (1977) and 10.81% by Chetty et al (1978).

Dutta et al (1976) reported incidence of retinopathy, nephropathy among 20 cases of coronary artery disease with diabetes to be 30.0% and 10.0% respectively.

Nigam et al (1980) observed that incidence of hypertension, nephropathy, retinopathy and peripheral vascular disease among diabetics with coronary artery disease were 35%, 15%, 60% and 25% respectively.

Diabetes and silent myocardial infarction -

Because of increased frequency of coronary artery disease as a cause of death in majority of diabetics study of silent and unusual features of clinical presentation, and the clinical impression that myocardial infarction in diabetic patients occurs with less severe symptoms and more often it is silent, is stressed in number of studies (Bradley and
Schonfeld, 1962, Sarvotham and Berry, 1968 and Singh et al., 1976).

Painless myocardial infarction has been observed in 10% of non-diabetic population by Lindberg, 1960 and in 11% non-diabetic cases by Stockes and Dawber, 1959.

On the other hand, Bradley and Schonfeld, 1962 observed painless myocardial infarction in 42% diabetics, Agar et al (1962) in 61.1% diabetics, Banarjee (1966) in 60% cases, Mukharjee (1971) in 11.7% and Bradley and Partiaman (1965) in 24.2% cases.

Singh et al (1976) also stressed that myocardial infarction occurs less severly among diabetic population. He observed silent myocardial infarction in 28.9% of diabetics. All of these observation emphasises the importance of silent myocardial infarction among diabetics.

Diabetes and site of myocardial infarction -

Banarjee and Roy (1959) observed a special predilection of myocardial infarction for anterioseptal region while Dutta et al (1976) reported for predilection for inferior wall myocardial infarction, Singh et al (1976) for anterior wall. Pathania and Sachar (1961) could not observe any such prediction.
Fascicular Blocks—

Reports of incidence of fascicular block among diabetics have been scanty and very little of attention has been given to them.

In a study of 122043 persons, Hiss and Lamb (1962) reported the incidence of fascicular blocks to be 0.18% in normal population. Ostrander (1964) diagnosed only 36 cases of fascicular blocks among 8641 individuals of hospital population (0.41%).

Higher incidence of fascicular blocks has been reported among diabetics. Partiaman and Bradley (1966) observed fascicular block in 6.3% diabetics, Dutta et al (1976) in 6.11% diabetics and Singh verma et al (1978) in 7.3% cases. Incidence of fascicular blocks increased with advancing age in diabetics and majority of diabetics with fascicular block were from elderly age group (Singh verma, 1978).

Singh et al (1978) observed fascicular block in 52 cases out of 711 diabetics (7.3%). Right bundle branch block (Singly or in combination) was the commonest fascicular block and it was observed in 38 cases (5.34%). It was sole manifestation in 30 cases (4.2%). The incidence of fascicular block was significantly high in diabetics without ischaemic heart disease than the diabetics with ischaemic heart disease (p < 0.01). On the basis of these
observations, Singh et al (1978) attributed that fascicular block will be because of separate disease identity than arteriosclerotic process. This mechanism may be same as has been suggested for diabetic cardiomyopathy by Rubler et al (1972) and Tripathy et al (1975). This view is strengthened by the histological studies of Panja (1976) who had demonstrated microangiopathic involvement of small vessels of heart.

**CARDIAC ENLARGEMENT AND CARDIOMYOPATHY**

Rubler et al (1972) reported that patients with long standing diabetes who have renal disease (proved cases of diabetic glomerulosclerosis) may have concomitant myocardial changes which can not be attributed to major coronary artery involvement, hypertension vascular disease or neuromuscular disease, excessive ingestion of Alcohol or to associated renal disease or uraemia therefore, they must be considered to have a cardiomyopathy not previously discribed. These cases manifest the clinical finding noted in primary cardiomyopathy and associated with pathological lesion characterized by myocardial hypertrophy, fibrosis and alteration of small vessels of heart.

Tripathy et al (1975) reported 14 cases of unexplained cardiomegaly among diabetics and discussed the possibility of cardiomyopathy. Similarly Dutta et al (1976) reported 15 cases of unexplained cardiomegaly, Agarwal et al (1977) reported 3 cases, Chetty et al (1978) reported 2 cases and Nigam et al (1980) reported 2 cases of unexplained cardiomegaly and they attributed them to be due to
cardiomyopathy in diabetics as described by Rucler et al (1972). Panja et al (1976) studied changes in heart of 20 diabetics and described microangiopathic changes in them and suggested that this microangiopathy may be responsible for cardiomegaly, cardiac failure and conduction defects in diabetics.

Excercise test for evaluation of cardiac performance in diabetics -

Pathological, clinical and epidemiological studies have shown that in diabetic subjects, the incidence of coronary artery disease is higher than non-diabetic subjects. (Glowson and Bell, 1949).

Extensive followup studies (Master et al, 1929 and Master and Rosenfeld, 1962) have confirmed the value of Master's two step exercise test by later appearance of anginal syndrome, and abnormal resting E.C.G. , a dramatically positive exercise test, an enlarged heart, heart failure and subendocardial or transmural infarction.

Bellet and Roman (1967) observed the incidence of positive stress test to be 22.3% in diabetics while it was positive in only 8-12% cases in non-diabetic unselected population using the similar technique and criteria. Stress test was positive in 22% of diabetics above the age of 40 years while the incidence of positive stress test were as high as 17.4% in young diabetics (below the age of 40 years) even.
HYPERTENSION

Lunbaek (1954) found the incidence of hypertension to be 68% in a series of 234 diabetics. Incidence of hypertension among diabetics has been observed by Banarjee and Roy (1959) 43.4%, by Pathania and Sachar (1961) 27.8%, by Tulloch (1962) 40.2%, by Abou khatwa (1963), 20.2%, by Vaishnav et al (1964) 17.6%, by Banarjee and Mukharjee (1967) 45.3%, by Lal et al (1968) 18.9%, by Mukharjee (1971) 40%, Agarwal et al (1977) 30%, by Nigam et al (1977) 32.7% and by Singh verma (1979) 14%.

Age - Pathania and Sachar (1961), observed an increase in incidence of hypertension among diabetics up to age of 69 years (seventh decade) and highest percentage (44.8%) was observed in eighth and ninth decades. It was significant that 57% of diabetics under age of 30 had hypertension. The largest number of (46.38%) of hypertensive diabetics were in age group of 50-59 years. Similar incidence has been reported by Wig et al (1953) in a study of unselected hypertensives.

Freedman et al (1958) could not observe any significant difference in incidence of hypertension among diabetics and non diabetics up to age of 69 years and thereafter hypertension was more common to a significant degree among diabetics and they attributed the higher incidence of hypertension amongst diabetics to age distribution of the cases.
Mukharjee (1971) observed hypertension to be more frequent in elderly diabetics. This trend has also been observed in general population (Hamilton et al, 1954). Balme and Cole (1951), Banarjee (1966), Tulloch (1962) and Banarjee and Roy (1959) found an increase in incidence of hypertension with advancing age and highest incidence in age of 70 years or above. Vaishnav et al (1964) have observed the incidence of hypertension to be highest in 6th decades including male and female. On further breaking up, it was more common amongst females in 6th decade. Whereas amongst male diabetics aged 40 years or more, no significant increase in its incidence was observed. The highest incidence of hypertension amongst male, female and all diabetic cases of this series was in 7th, 8th and 9th decades respectively.

Sex - Bryfogle and Bradley (1957) observed hypertension more frequently in males. Freedman et al (1958) reported hypertension to be almost 3 times more common among females (1.4%) than males (0.5%). Tulloch (1962) also observed similar incidence. Vaishav et al (1964) reported that hypertension is two times more common among male diabetics than female diabetics. Mukharjee (1967) and Banarjee (1966) also found hypertension more common among males. Mukharjee (1971) reported that hypertension occurred more frequently in males (47%) than in females (27%). While Agarwal et al (1977) could not find any definite correlation between hypertension and sex incidence amongst diabetics.
**Duration** - Pathania and Sachar (1967) observed that 71.6% of diabetics were having duration of diabetes for more than 5 years. Mukharjee (1971) reported increasing incidence of hypertension with prolongation of diabetes. While Lewis and Symons (1958), Agarwal et al (1977) and Nigam et al (1980) could not observe any such relationship.

**Serum cholesterol and lipoproteins** -

Suri et al (1979) reported mean serum cholesterol levels to be 236.38 mg% among diabetics with hypertension and levels were significantly high in comparison to control group. Hyperlipoproteinaemia was detected in 69.2% of hypertensives and type IV hyperlipoproteinaemia was commonest pattern (7 out of 13).

**Associated features** -

Liebow et al (1955) found that coronary artery disease occurs more frequently among hypertensive diabetics in comparison to non-diabetic hypertensive. Lewis and Symons (1958) also reported that vascular complications occur more frequently among hypertensive diabetics than non-hypertensive diabetic. Pathania and Sachar (1967) observed that out of 97 hypertensive diabetics, coronary artery disease was present in 37 diabetics (32%). This incidence was about twice that of coronary disease among non-hypertensive diabetics (17.9%). Out of this, 17 cases (17.5%) had diabetic nephropathy. Agarwal et al (1977) observed nephropathy and ischaemic heart disease more
frequently in hypertensive diabetics than non hypertensive diabetics. Nigam et al (1980) observed associated ischaemic heart disease and nephropathy were more common in hypertensive diabetics in comparison to normotensive diabetics. Incidence of associated coronary artery disease, nephropathy and peripheral vascular disease was 41.2%, 47.0% and 29.4% respectively.

**DIABETIC NEPHROPATHY**

Since the discovery of insulin in 1921, the life expectancy of diabetic subjects has increased and instead of coma and infection control, they are dying more often of uraemia. This created the interest in study of renal vascular pathology so called diabetic nephropathy. Kimmelstiel and Wilson (1936) described nodular glomerulo nephritis in diabetic kidney. Subsequently Hall (1952) described the exudative glomerulosclerosis (Hyaline and fibroid lesion). Wilson et al (1951), in an extensive study of glomerular fat, demonstrated the high lipid content in the glomerular lesions and draw the attention that a fatty lesion was one of the initial occurrence in the development of these pathological deposits. Subsequent workers like Engelberg et al (1952) and Keiding et al (1952) carried further work to study the serum lipid, lipoproteins together with serum cholesterol in diabetic subjects with nephropathy.

**Incidence** - Lundbaek (1954) in his extensive study on 234 cases, found the incidence to be 25% of nephropathy.
Bryfogle et al (1957) studied 394 cases of diabetes and observed that diabetic nephropathy was present in 10% of all patients. While Pathania and Sachar (1961) in a series of 349 cases observed diabetic nephropathy in 5.7% cases. Diabetic nephropathy has been observed in 4.1% cases by Lewis and Symons (1958), 15.3% by Tulloch (1962), 2.6% by Abou khatwa (1963), 19% by Banarjee and Mukharjee (1967) and 16% by Mukharjee (1971). Recently Agarwal et al (1977) reported its incidence (35.9%) in series of 53 diabetics and Singh verma et al (1979) reported it to be 11% in series of 100 diabetics and Nigam et al (1980) observed it in 21.2% cases in a series of 52 diabetics.

**Age -** A positive correlation between diabetic nephropathy and advancing age has been reported by Kimmelsteil and Porter (1948) and Lal et al (1968). Pathania and Sachar (1961) and Hall (1952) observed an increasing incidence of diabetic nephropathy from 40 years until seventh decade. Abou khatwa et al (1963) reported that 90% cases of diabetic nephropathy were below age of 40 years while Mukharjee (1971) reported that only 12.5% cases of diabetic nephropathy were of less than 40 years. Recently Gupta et al (1980) reported the incidence of diabetic nephropathy higher in 4th and 5th decade of life (90.4%).

**Sex -** Pathania and Sachar (1967) observed preponderance of male diabetics (61.1%) over female (4.8%) with diabetic nephropathy. Bhal et al (1967) and Bixit et al (1966) have also shown higher incidence of nephropathy in males.
Kimmelstiel and Porter (1948) have suggested higher incidence of nephropathy in females. Wilson (1957) also observed that diabetic nephropathy occurs as frequently as twice among female diabetics than male diabetics.

**Duration of diabetes**

Bryfogle and Bradley (1957) observed that diabetic nephropathy occurs more commonly in diabetics having disease for longer duration. In a series of 100 diabetic patients, Mukharjee (1971) shown that incidence of diabetic nephropathy was increased with prolongation of diabetes, reaching to its peak in diabetics having the disease for more than 15 years (25%). Pathania and Sachar (1961) studied 349 diabetic and they found that 77.8% of diabetics with nephropathy were having duration of diabetes of more than 5 years. Tulloch (1962) has observed increased incidence of nephropathy with prolongation of diabetes. In number of other studies it has been emphasized that there is a direct relationship of diabetic nephropathy with increasing duration of diabetes (Goodof, 1945, Henderson et al, 1947, Kimmelstiel and Porter, 1948, Dunlop, 1954, Gupta and Chakravarti, 1964 and Bhal et al, 1967). Recently Gupta et al (1980) reported a definite correlation between duration of diabetes and diabetic nephropathy. In his study, incidence of diabetic nephropathy was 100% in diabetics with duration of disease more than 10 years.
Associated complications -

In the literature, hypertension in diabetic glomerulosclerosis has been reported to be 85.7% (Kimmelstein and Wilson, 1936), 19.4% (Dixit et al, 1966) and 6.2% (Mathur et al), 1964). Recently Gupta et al (1980) have observed hypertension in 32.7% cases of diabetic nephropathy. Wagner (1945) and others have reported studies correlating antemortem ophthalmoscopic examination with postmortem examination of kidney. They found 80-90% of patients having nephropathy, had retinopathy, Vaisnav et al (1971) observed associated retinopathy in 30.9% of cases with diabetic nephropathy, while Gupta et al (1980) reported the incidence of associated retinopathy to be 51.5%.

Serum Cholesterol -

Man et al (1949), Keiding et al (1952), Demanet et al (1959), Mahallawy et al (1960) and Sinha and Ghosh (1960) observed significantly high serum cholesterol levels in diabetics with nephropathy. Suri et al (1979) observed mean serum cholesterol in diabetics with nephropathy to be 297 mg% and values were significantly higher in comparison to control group.

Lipoproteins -

Keiding et al (1952), Engelberg et al (1952), Demanet et al (1959), Sinha and Ghosh (1960) and Kumar and Gupta (1967) observed significantly high beta lipoprotein
in diabetics with nephropathy. Srivastava et al (1979) studied 40 cases of diabetes. Out of 7 cases of nephropathy, 85.71% had hyperlipoproteinaemia and type IIa was commonest pattern seen in diabetics with nephropathy.

**DIABETIC RETINOPATHY**

Ashton (1949) was first to describe the occurrence of diabetic changes in retinal vessels. Ballantyne and Lowenstein (1943) described the capillary changes and characteristic microaneurysm and there by gave a new direction to research on this highly important disorder. Ballantyne (1946) described and classified ophthalmoscopic appearance of diabetic retinopathy. With the advent of electronic microscopy, attention has shifted somewhat from vessels to retinal cells (Wolter, 1961 and Bloodsworth, 1962). Now insulin has almost produced its maximum affect in prolonging diabetic life. It is possible to imagine that thousands of diabetics will be registered as blind in coming years due to retinopathy. In 1960, in London, the 752 cases of diabetic retinopathy formed 7.5% of total registration and this lesion was fifth in diagnostic classification (Sorsby, 1963). In the age group of 30-39 years, diabetics formed 15% of the newly registered blind and diabetes was responsible for 13% of blindness in age group of 50-59 years.

Diabetic retinopathy has been observed in 20.6% cases by Wagner,(1945), 24% by Soutomaor and Besisio (1947), 33.2% by Larsson et al (1952), 32.9% by Markman et al (1959), 35.8% by Bryfogle and Bradley (1957), 21.7% by Lewis and

**Age** - Mukharjee (1971) observed diabetic retinopathy more frequently among elderly diabetic than in young diabetics and incidence was 100% in diabetics with age group of 70-79 years. While incidence was nil in age group of 20-29 years. 57.1% of the cases with diabetic retinopathy were in age group of 5th and 6th decades. Abou khatwa (1963) observed that 73% of their diabetic patients with retinopathy were in age group of 5th and 6th decades.

**Sex** - Mukharjee (1971) observed that out of all cases with diabetic retinopathy, 42.9% were female and incidence of diabetic retinopathy was more among females (9 out of 26 females) in comparison to males (21 out of 74 males). Abou khatwa (1963) reported that 62% were female in series of diabetics with retinopathy.

**Duration** - There is now general agreement that retinopathy becomes common with advancing age but much more with duration of diabetes. The greater incidence of diabetic retinopathy has been reported in diabetics with duration of illness over 5 years (Wagner, 1945, Scott et al, 1951, Abou khatwa, 1963).
Martensson and Palm (1950) and Scott (1951) found only 41% in cases of more than 15 years of diabetes.

**Associated complications** -

Definite correlation between retinopathy and clinical nephropathy is well documented among diabetics (Wagner, 1945, Pathania and Sachar, 1961, Vaishnav, 1971 and Gupta et al, 1980).

**Serum Cholesterol** -

Keiding et al (1952), Demanet et al (1959) and Lowy and Barach (1957) observed significantly high serum cholesterol in diabetics with retinopathy. Suri et al (1979) reported mean cholesterol to be 239 mg% in diabetics with retinopathy and values were significantly higher in comparison to diabetics without retinopathy and control group.

**Lipoproteins** -

Keiding et al (1952), Kumar and Gupta (1967) and Lowy and Barach (1957) observed significantly higher beta lipoproteins in diabetics with retinopathy in comparison to control group and levels of serum cholesterol increased with severity of retinopathy. Srivastava et al (1979) observed hyperlipoproteinaemia in 50% cases of retinopathy and type IV hyperlipoproteinaemia was commonest pattern. Suri et al (1979) reported type IV pattern as commonest abnormality.
PERIPHERAL VASCULAR DISEASE

Incidence - The incidence of peripheral vascular disease varied from 2.47% to 17.0%. Bryfogle and Bradley (1959) reported the incidence of peripheral vascular disease to be 15.7% in a series of 394 diabetic patients. Peripheral vascular disease was observed in 17.0% diabetics by Lewis and Symons (1959), 4.1% by Tulloch (1962), 3.8% by Abou khatwa (1963), 2.4% by Mukharjee (1966), 5.0% by Banarjee and Mukharjee (1967), 4% by Mukharjee (1971) and 5% by Singh varma (1979).

But Agarwal et al (1977) reported the incidence of peripheral vascular disease to be as high as 49.1%. It was probably due to the inclusion of latent peripheral vascular disease as diagnosed by low 2nd digital pressure. Nigam et al (1980) similarly reported high incidence of peripheral vascular disease (46.1%).

According to Bell (1957) and Pederson and Olsen (1962), gangrene in the foot of diabetics is more common than non-diabetic subjects. Mukharjee (1967) found occlusive vascular lesion leading to ischaemic gangrene of feet and toes to be 6% in a series of 100 diabetics.

In contrary, Lewis and Symons (1958) have observed intermittent claudication more frequent than gangrene. Intermittent claudication was not a feature amongst cases of Sample (1953).
Age - Gangrene has been observed in 10%, 15% and 20% cases in 5th, 6th and 7th decades respectively by Bell (1960), in a series of 2529 diabetic patients. Mukharjee (1971) observed the incidence of gangrene in a series of 100 diabetic patients to be 9.5%, 6.9% and 7.1% cases in 5th, 6th and 7th decades respectively.

Sex - Diabetic females and males develop gangrene 71 times and 53 times respectively as compare with non-diabetic subjects (Bell, 1957). Bell (1957) and Mukharjee (1971) observed peripheral vascular disease more frequently among male diabetics than female diabetics.

Duration - Brandman and Redisch (1953) studied the incidence of vascular changes in diabetics. Relative peripheral arterial insufficiency (postural colour changes or absent pulsation in at least one foot) was found in 30% cases with in 5 years of diabetes and 52% with in 15 years of diabetes. Duration of disease influenced the incidence of peripheral vascular disease. Oakley et al (1974) also observed increased incidence of peripheral vascular disease with prolongation of diabetes.

Cholesterol and lipoproteins - Suri et al (1979) observed one case of peripheral vascular disease in 56 diabetics and serum cholesterol level was 316 mg% in that case. It was significantly high than the control group and he had type IV
hyperlipoproteinaemia.

Associated complications-

Brandman and Redisch (1953) observed that hypertension is a positive factor affecting peripheral vascular disease.

MICROANGIOPATHY

The vascular abnormality in smaller vessels e.g. arterioles, capillaries and venules have been embossed under the term microangiopathy. The higher frequency of peripheral vascular disease in diabetics as compared with control led to believe that microangiopathy is an important factor in diabetics mellitus.

Pederson and Olsen (1962) studied the skin muscle biopsy of lower extremity in 20 diabetics. They showed a characteristic diffused but segmentally distributed angiopathy of small vessels. This microangiopathy is supposed to be the primary factor in occurrence of lesion in diabetes. Hairman (1965) described vascular lesion of diabetes mellitus is the form of microangiopathy. It consist of proliferation of endothelium of the intima and thickening of basement membrane.

Incidence - Hendelsman et al (1962) reported microangiopathy in skin of 6 out of 6 diabetics while it was present in only 1 out of 13 non diabetics subjects. Banson and Lacy (1964), reported that incidence of vasculopathy
is higher i.e. 88.0% among diabetics as compared to 23% of control group. Moore et al (1966) reported characteristic angiopathy in 46 out of 52 diabetics and only 3 out of 52 non-diabetic control group. They have also reported that incidence of severe degree of angiopathy was significantly higher in diabetics with foot lesion than in those without foot lesion. Vaishnav et al (1967) observed histological evidence of endothelial proliferation and/or P.A.S. positive basement membrane thickening singly or together in skin and/or muscle in 52.5% diabetics.

**Age** - Vaishnav et al (1966) observed a positive correlation of microangiopathy with age. Their diabetic patients who were above 50 years of age showed microangiopathic changes. Similar reports are given by Jordan and Pearl (1972) and Kilo et al (1972).

**Duration** - The analysis of duration of diabetes reveals that duration affects development of microangiopathy (Pardo et al., 1972, Kilo et al., 1972, Larsson, 1967). All the above mentioned workers reported basement membrane thickening in almost 93% cases of over 20 years duration of diabetes.

**Associated complications** - Vaishnav et al (1967) found that microangiopathic changes in skin may be associated with retinopathy and nephropathy. They observed a close association between microangiopathy and peripheral vascular disease. However, they could not find any correlation between ischaemic heart disease and microangiopathy.