A PROSPECTIVE OBSERVATIONAL STUDY OF VASCULAR COMPLICATIONS IN DIABETIC POPULATION

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ABSTRACT

OBJECTIVE

The main objective of our study is to observe the micro & macrovascular complications in diabetic population and assessing the HbA1C range and onset of DM in affected subjects.

METHODS

Case sheets of 200 diabetic patients with vascular complications was collected and observed by questioning the patient regarding onset of DM, food habits, life style, by attending the ward rounds in KIMS - SUNSHINE hospitals from September-2022 to February-2023.

RESULTS

200 subjects are enrolled in the study which includes 120 males (60%) 80 females (40%). The most commonly occurred vascular complication among both males and females is CAD in the department of Cardiology. Within CAD, TVD(14) had observed majorly followed by NSTEMI(12).ICS is the more frequently observed complication in Neurology in both males(21) and females(15). Most of the vascular complications are at the HbA1C range of (8.1 – 9.0%) in males and (7.1 – 9.0%) in females. Onset of DM (6 – 10 years) had recorded highest rate of complications in both men and women.

CONCLUSION

Regular monitoring of glycemic status followed by fair control in HbA1C range, dietary modifications, lifestyle modifications decrease the risk of developing of vascular complications. We have to aware and educate the patient by conducting patient education programs.

DIABETES MELLITUS

INTRODUCTION

- DM is a long-term incurable common endocrine metabolic disorder distinguished by high blood glucose levels and interference in fat, carbohydrate, and protein metabolism.
- It is because of a lack of proper insulin secretion or insulin sensitivity (susceptibility) Diabetes Mellitus is classified as follows:

Type 1

- Seen in 10% population
- Occurs in younger age
- Insulin-dependent
- Inadequacy of insulin objects decreased glucose uptake by fat and skeletal muscle.

Type 1 DM is subdivided into -

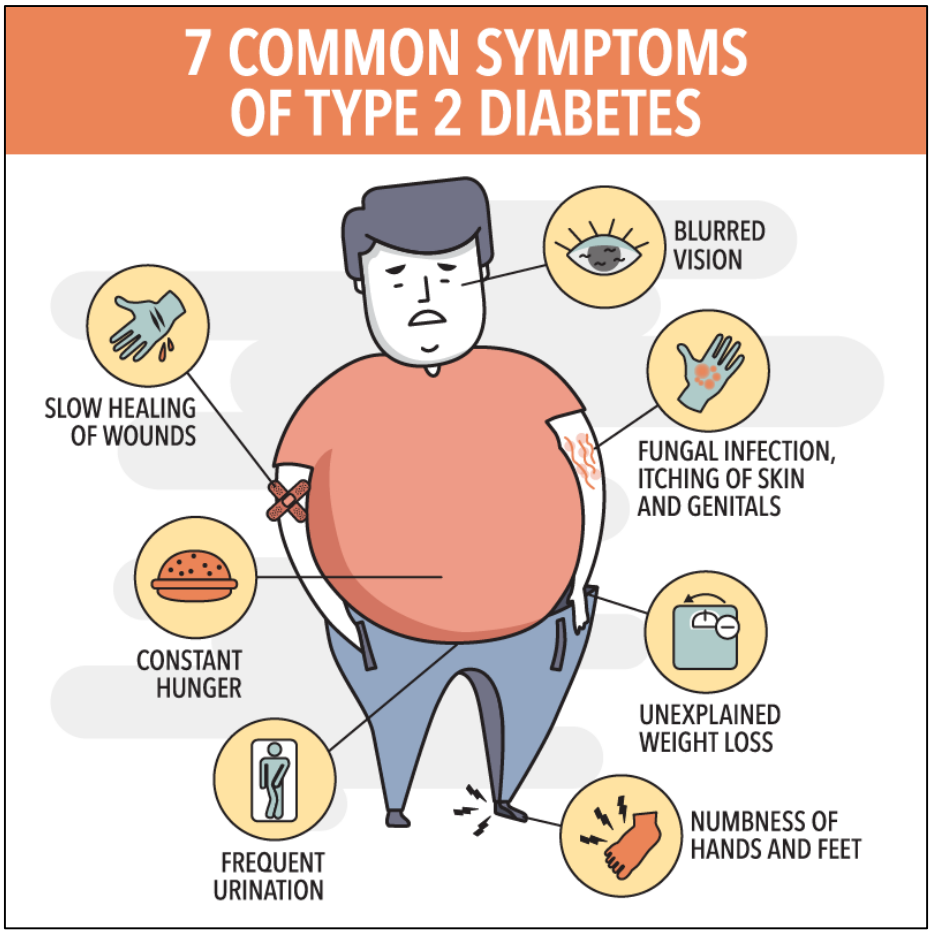
A. Type A
   - It is expressed by autoimmune annihilation of beta cells thus leading to insulin inadequacy.

B. Type B
   - These subjects are negative for autoimmune markers but, insulin deficit is seen.
   - Idiopathic

Type 2 (fig1)

- seen in 80% population
- occurs in middle age
- Noninsulin-dependent
- End-organ damage is seen
- Obesity Sources declined a number of insulin receptors
- Sufficient insulin is not produced by pancreas (Insulin deficit) or body does not utilize insulin well (Insulin resistance).[1]

FIG – 1



Other types

- Seen in 10% of population

This includes:

- Genetic defect -Mutations in β cells thus leading to dysfunction.
- Diseases of pancreas – chronic pancreatitis
- Infections
- Other genetic syndromes – eg: Down syndrome

Gestational Diabetes – It is referred to as intolerability of glucose during pregnancy.[2]

TABLE - 1

TYPE 1 & TYPE 2 DM

	TYPE 1 DM	TYPE 2 DM
Cause:	●The body is unable to make insulin ●Pancreas is injured by an autoimmune attack	●Body synthesis insulin, but doesn't make enough ●Pancreas is not damaged
Age	Evolve during childhood	Can evolve at any age but is common in adults
Risk factors	Origin due to family history	Origin due to corpulent HTN
Prevention	No known hindrance methods	Maintaining healthy conduct
Signs and symptoms	●Reduced weight loss ●Recurrent Micturition ●Acerbity ●Indistinct power of sight	●Infections ●Distended body weight ●Unhurried wound healing ●Insensibility in hands and feet ●Exhaustion
R_x	Insulin injection	●OAD Medications ●Healthy lifestyle ●Insulin injection

Pathophysiology of Type 1 DM

Increased lymphocytic infiltration

↓

Demolition of β cells of islets

of Langerhans which produces insulin in the pancreas

↓

β cells abundance turns down

↓

Insulin production declines up till the obtainable insulin no longer is

Requisite to continue normal blood glucose levels

↓

Following 80 – 90 % of β cells demolition hyperglycemia

Evolve and diabetes may be spotted

Response to fasting state

Fasting state

Reduced blood glucose concentration

α cells stimulated to produce glucagon

Glycogenolysis

Normal blood glucose concentration

Pathophysiology of Type 2 DM

Peripheral insulin resistance and deficient insulin production

by pancreatic beta cells

Multiply levels of Cytokines and proinflammatory

free fatty acids in plasma

Declined glucose shifts into cells of muscles

Production of hepatic glucose is elevated

Elevated fat breakdown

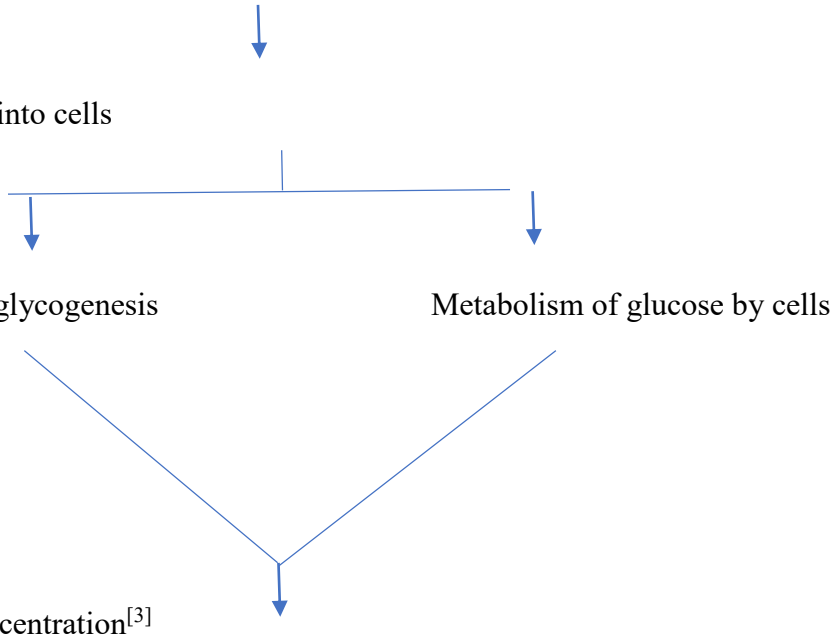
Insulin resistance is due to a high calorific diet, steroids, decreased physical activity

Glucose Metabolism

Consumption of food

Elevated blood glucose concentration

Beta cells stimulated to produce insulin



Normal blood glucose concentration[3]

EPIDEMIOLOGY

- -It is estimated that 5,37,000 people suffering from DM based upon Study in 2019.
- About 200 thousand people lost their lives in 2020, directly due to DM. It is the 9th leading disease-causing mortality/deaths globally.
- Earlier to 2019, it is reported that 463,000 thousand adults are living with diabetes.
- Patient population may shoot up to 6,43,000 thousand by the year 2030
- It is roughly calculated by WHO that DM resulted in 15 lakh deaths in the year 2012 making it as 8th most significant[4]

Asia- China

- one in four adults is diabetic in China.
- Approximately more than 140 lakh Chinese adults are estimated to be diabetic in 2021 in accordance with International diabetes federation. It is expected to rise by 30%. within 7 years.[5]

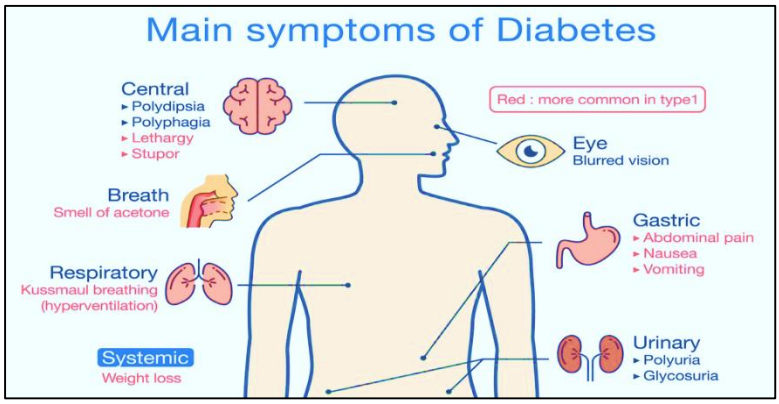
India

- It ranks 2nd place in people existing with diabetes
- Greater than 74 lakh Indians are presently affected with diabetes which is greater than 8.3% in adult Public. About 57% of contemporary cases of DM are not distinguished approximately
- About 109 lakh people are estimated to be diabetic by 2035. In accordance with Indian Heart Association
- Diabetes is affecting 31.7 lakh people in India during the year 2000 in consonance with WHO. This statistic is guessed to hike to 79.4 lahks by 2030
- India Put down evident as the diabetes capital of the world i.e, huge digit in any nation in world. [6]

SIGNS AND SYMPTOMS

- **Polydipsia:** subject feels the urge to drink the water due to enhanced sugars levels in the blood
- **Polyuria:** Excessive urine production is due to the body's attempt to toss out additional glucose in the blood by eliminating it through the urine. This causes excessive loss of fluids.

FIG - 2

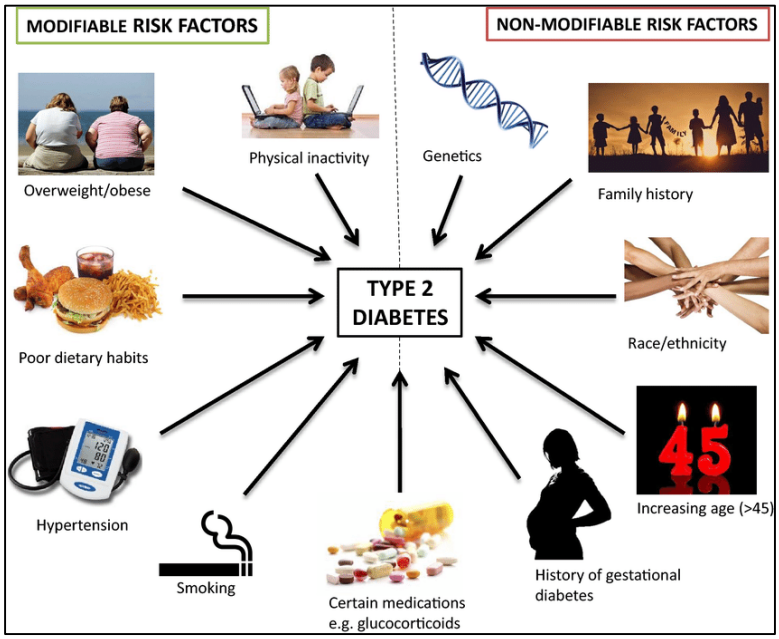


- **Fatigue** (increased tiredness): increased sugar levels cause decreased processing of glucose as energy which may lead to fatigue
- **Uncontrolled variations in body weight**: DM intervenes with glucose stability leading to enhanced triglyceride and glucose levels – increased body weight. Metabolism of protein and fat may lead to decreased body weight.
- **Decreased Eyesight:** swelling of the eye lens due to hyperosmolar hyperglycemia affects the ability of the lens to focus thus, leading to blurry vision.
- **Irritability:** Deficiency of glucose availability to the brain and other parts of the body leads to feelings of irritation, depression, and uneasy.
- **Diminished Immunity:** subject may be prone to frequent infections (fungal, bacterial) due to high blood sugars which leads to suppression of the immune system.
- **Impaired wound healing:** increased blood glucose levels lead to vasoconstriction – poor blood circulation making it tough for supply of blood required for wound healing due to decreased leucocytes flourishing.
- **Polyphagia (Hyperphagia)**: Insulin is responsible for triggering hunger for increased blood sugars – body synthesis insulin which leads to increased appetite.

RISK FACTORS

- **Being obese:** obesity accounts for 80-85% of the risk for developing type 2 DM. In an obese patient, the amount of glycerol, cytokines, and fat are involved in developing insulin resistance. Thus, insulin resistance leads to impaired β cell functioning causing DM.

FIG - 3



- **Age:** decreased insulin secretion, increased insulin resistance, and abnormal pancreatic islet function occur with aging which causes hyperglycemia.
- **Genetics:** mutations (change in a single gene) cause DM
- **Family History:** type 2 has a stronger link and runs in families, even though the environment and lifestyle factors play a major role.
- **Consumption of Alcohol:** daily, binge intake of alcohol can bring down the body's responsiveness to insulin which triggers type 2 DM.
- **Smoking-** nicotine drives firmer for cells to retort to insulin thus, raising blood sugars.
- **Physical inactivity-** patients with a sedentary lifestyle have an elevated risk of occurring type 2 DM due to insulin resistance.
- **Gestational Diabetes-** around 50% of mothers with gestational diabetes develop type 2 DM as a result of pancreatic β cell dysfunction with preexisting insulin resistance.
- **Diseases of the Pancreas-**due to the abnormal functioning of the pancreas, the body is unable to utilize insulin thus, leading to high blood sugar.
- **Impaired glucose tolerance-**Impaired glucose tolerance is due to insulin resistance & incapability of insulin flow to fully remunerate for insulin resistance.
- **Ethnic background-**African Americans bear limited Potassium than white. A K+ deficit is associated with immense risk for emerging type-2 DM
- **PCOD-** Androgen increment occur with PCOD that accompanied by abdominal build up that in addition devote insulin resistance
- **Insomnia-** sleep disturbances is related to glucose metabolism thus changing balance of hormone leptin and ghrelin which influences appetite & triggers overeating it also deprive insulin sensitivity. [7]

Regulation of insulin

1. Chemical regulation
2. Hormonal regulation
3. Neural regulation

1. Chemical Regulation

β cells having action of glucose sensing

depends on ↓

Glucose access into β cells

↓

Activation of glucose sensory Mechanism

↓

which indirectly inhibit ATP sensitive K+ channel

↓

Results in Partial depolarization

↓

This ↑ses intracellular Cat^2 availability.

↓

which leads to exocytic release of insulin from insulin storing cells.[8]

2. Hormonal Regulation

- Corticosteroids, thyroxine- Causes release of insulin
- Somatostatin inhibits the release of Insulin
- There is an interaction occurs b/w hormones & intra islet Pancreatic β cells

3. Neural Regulation

Adrenergic β_2 receptor stimulation increases insulin release by stimulating the adenyl cyclase.

Action of Insulin:

On Carbohydrate Metabolism

- In liver, it facilitates glucose uptake & increase glucogenesis and inhibits the glycogenolysis
- In adipose tissue, it facilitates the glucose uptake by adipocytes and the increases triglyceride synthesis

On Protein metabolism

In liver, it inhibits the Protolysis & oxidation of amino acids

On fat metabolism

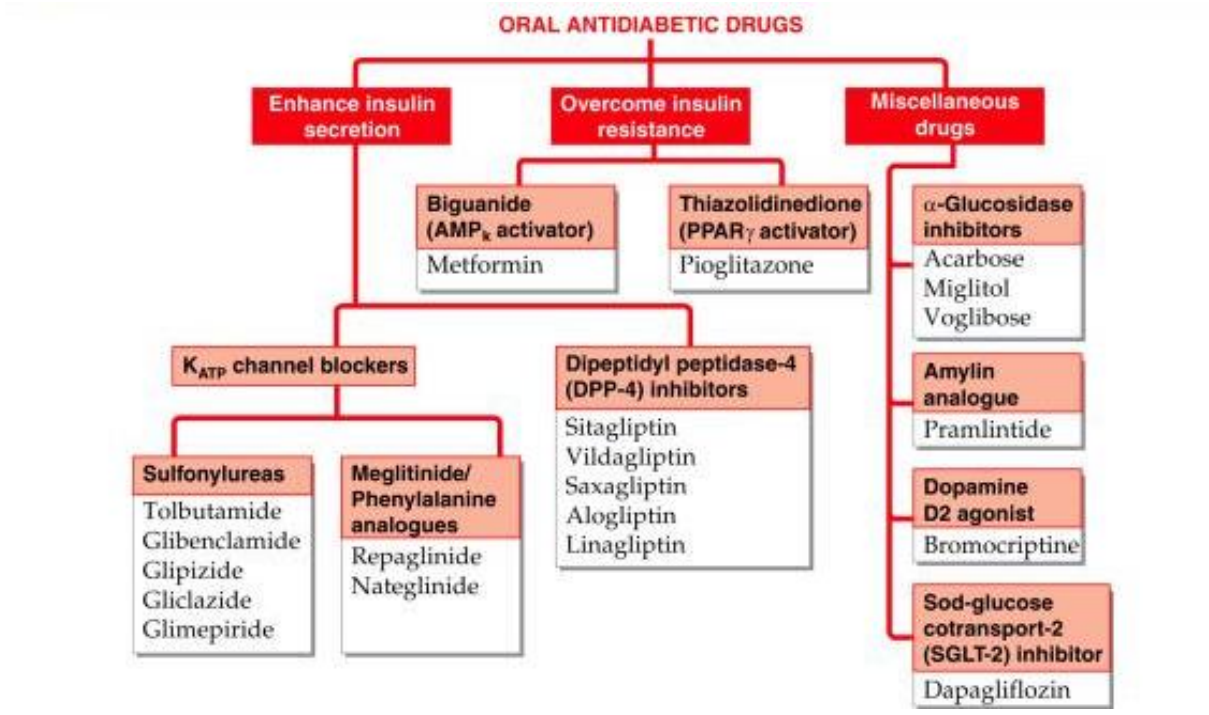
In liver, it enhances the lipogenesis

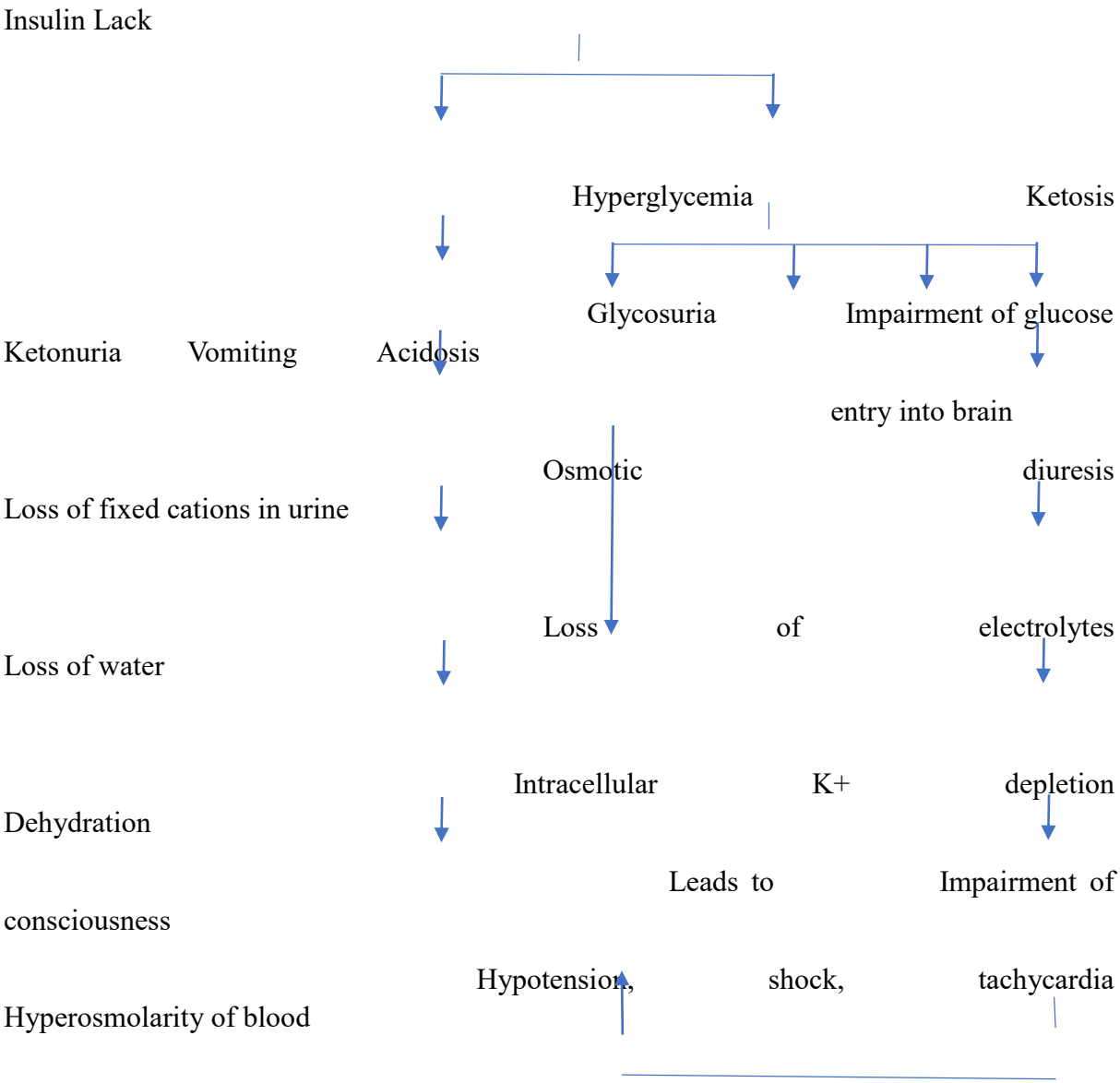
Other actions

- Insulin also facilitates the transport of Calcium and Potassium
- It stimulates the cell proliferation[9,10]

ORAL ANTIDIABETIC DRUGS

- **FIG - 4**





DIAGNOSIS

It is interpreted by following methods.

- A1c of 65% or greater
- **Fasting blood glucose (FBS) Test** - it computes blood glucose in anything Subject who had not Consumed anything least wise 8 hours. This test assures to expose diabetes & Prediabetes
- **Oral glucose tolerance test (OGTT)** - It computes blood glucose, executed only after all night fasting least wise 8-14 hours. This text assures exposing both Prediabetes and diabetes. Plasma sugars are computed following 2 hours of fasting.
- **Random Blood Sugar test (RBS)** It is usually Performed glucose test, that computes blood sugars. unaccompanied by a person's Fasting state. This test cannot assure to expose prediabetes
- Fasting plasma glucose Range 126mg/dl or more

- Oral glucose tolerance test- 200mg/dl or more[11,12,13]

INSULIN SLIDING SCALE

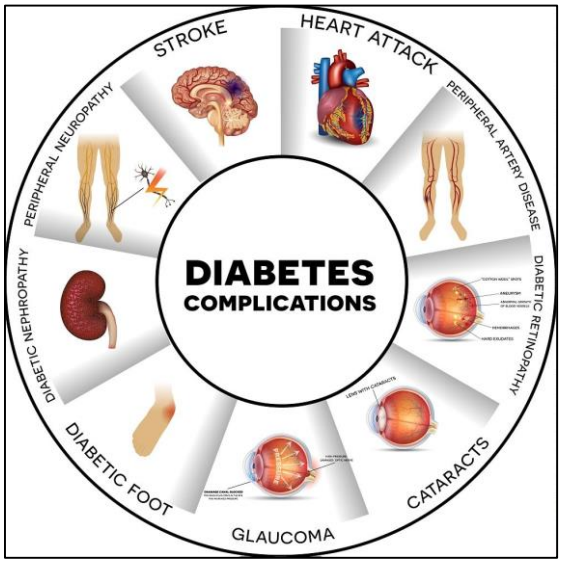
TABLE 2

GRBS	INSULIN (S/C)
150 – 200	6 Units
200 – 250	12 Units
250 – 300	18 Units
300 – 350	22 Units
>350	Infusion

VASCULAR COMPLICATIONS OF DIABETES

- Diabetes is associated to a broad variety of problems. Acute metabolic consequences associated to death include diabetic ketoacidosis produced by unusually high blood sugar (hyperglycemia) and unconsciousness induced by low blood sugar levels (hypoglycemia). This analysis will focus on what is perhaps diabetes's most serious complication: long-term vascular problems. These problems are many and are induced, at minimum in part, by prolonged rises in blood sugar levels, which induce blood vessel damage.[14,15]
- Diabetes causes persistent high blood sugar besides a number of microvascular problems like diabetic neuropathy, diabetic nephropathy and diabetic retinopathy, as well as major macrovascular consequences such like coronary artery diseases (CAD), peripheral vascular diseases (PVD), and cerebrovascular diseases.[16,17,18]

FIG - 5



- Diabetes consequences are characterized as "microvascular disease" (related to damage to smaller vessel) or "macrovascular disease" (caused by damage to the arteries) (related to damage to the arteries). Microvascular problems include eye illness, popularly recognized as "diabetic retinopathy," kidney disease, popularly known as "diabetic nephropathy," and neurological injury, generally known as "neuropathy." The most significant macrovascular problems are advanced cardiovascular disease, which culminates in myocardial ischemia, CVD, that appears as strokes. Although the fundamental reason is uncertain, there is additional cardiac dysfunction linked with diabetes that seems to be unrelated of atherosclerosis.[19,20,21]

Diabetes-related retinopathy

- Retinopathy is a condition caused by diabetes. Destruction towards blood vessels of the gentle tissue at the rear of the eyeball.
- Retinopathy can typically produce no symptoms or just modest visual abnormalities. Moreover, it does have the possibility of causing blindness.
- Anybody having either type 1 / type 2 Diabetes mellitus may acquire the illness. As long we suffer DM and the less effectively the blood sugar is regulated, the more probable it is that you may get this eye issue.[22]

Prevalence in Epidemiology

- Diabetic retinopathy is the major cause of avoidable blindness in working-age individuals in so many countries (20–74 years).
- Diabetic retinopathy is estimated to affect 40% (8% for retinopathy) of patients with DM2 and 86 percent (42percent in DM1). Other nations have similarly observed highest prevalence estimations. The lower prevalence rates recorded in several underdeveloped nations (for example, India) are anticipated to vary when the number of persons with diabetes grows (for example, owing to changing socioeconomic circumstances and rising obesity) and so do respective life - span (ie, diabetes duration) (ie, diabetes duration). However, data shows that the incidence for retinopathy gradually declining with in US and other industrialised countries,18, especially among patients who have type 1 diabetes.[23]
- This outcome might be related to improved management for systemic lifestyle factors in diabetes therapy. However, it is uncertain if this falling tendency would persist, since a number of diabetic patients and their lifespans are predicted to grow. According to the results of a study13 done throughout China, diabetic retinopathy is frequent, including prevalence reaching 43% for just DR and 63percent for vision-threatening retinopathy. These estimates are larger than those published in some other study of largely urban Chinese individuals, emphasizing that preventative actions throughout rural China must be emphasized. According to these estimates, an estimated 92 million Chinese individuals residing in rural regions have DR, including twelve million struggling with retinopathy.[24]

- Data from Singapore found about 34 percent of Asian individuals with diabetes exhibited indications with DR. These findings demonstrate how DR is indeed a substantial public health concern not just in high-income nations but also throughout Asia.[25]

INCIDENCE

Only a few community studies have documented a prevalence of DR. An overall 10-year incidence of retinal within Wisconsin Epidemiologic Study of DR within the US is 74%, and among those with retinopathy at baseline, 64% had even more severe retinopathy and 17% proceeded onto develop proliferative retinopathy. Throughout a 10-year follow-up, roughly 20 percent of individuals in DM1 and14-25 percent of people having DM2 developed macular edema. Findings from of the WESDR DM1 cohort's follow-up suggest that virtually all patients (97%) acquired retinopathy with time, with 1/3rd to half acquiring the vision-threatening illness (43percent acquired proliferating retinopathy while 29% developed retinal edema).Interestingly, in comparison to the initial 10 years' follow-up, where incidence rates were generally constant, the WESDR data suggest a decline in the annual incidence and development of diabetic retinopathy during the previous 15 years. Furthermore, persons with just a recent DM diagnosis had a decreased frequency & incidence of proliferative retinopathy. These results attest to the favorable effect of better diabetes care in high-income nations during the previous two decades.[26]

Types

Retinopathy with pre-proliferative alterations

Neovascular proliferation may develop from retinal ischemia induced by microvascular obstruction. Cotton wool patches, massive black blot hemorrhages, vein beads & loop, and intraretinal microvascular anomalies are all signs of ischemia. Cotton wool patches are white circles with feathery borders that signify small infarcts with in nerve fibre layers; if there are more then 5, they become clinically relevant.

Retinopathy with proliferative alterations

New vessel development may arise just at the optic disc or anyplace other than the retina. New arteries on the disc are extremely harmful to sight, and if allowed to grow, they commonly result in vitreous hemorrhage. When not treated, 26percent of "elevated" eyes with neovascular growth on the disc would develop to significant vision loss within two years. This percentage is lowered to 11% following laser therapy.

Advanced ocular disease

Progressive fibrovascular proliferation produces blindness owing to vitreous hemorrhage and traction visual loss with late diabetic proliferative retinopathy. When new vessels grow just on irises and within the anterior chambers of the drainage angle and neovascular glaucoma may occur, leading to a painfully blind eye that sometimes needs enucleation.[27]

SYMPTOMS

- Mostly in initial phases in DR, people might don't even notice any signs. when the illness progresses, you may encounter: floaters (spot or black threads swirling in your eyesight) blurred vision
- Sight fluctuation
- Darker or blank regions in ones range of view
- Loss of vision

RISK FACTORS

- DR may affect everyone with diabetes. Developing diabetes for a prolonged period might raise your chance of developing an eye problem.
- You have poor blood sugar management.
- High Blood pressure
- Elevated cholesterol levels
- Smoking
- Pregnancy

COMPLICATIONS OF DR

Dr is characterized by the formation of aberrant vessels throughout the retina. This may result in serious eyesight problems

Vitreous Hemorrhage

- The newly formed blood vessels may flow into the transparent, jellylike fluid which covers your eye's middle. If the quantity of bleeding is minimal, you could only detect a few black patches (floaters). Fluid may fill the cavity of vitreous and entirely obstruct your eyesight in more severe situations.
- Hemorrhage in Vitreous does not generally result in permanent eyesight loss. Blood normally flushes out from eye after few days. Except if your retina is injured, ones eyesight would almost likely recover to usual.
- Detachment of a retina. Diabetic retinopathy has been characterised by aberrant blood vessels that accelerate the creation of wound, which may force its retina out from the posterior of eye. It might result in swirling dots, light flashes or extreme loss of vision.

Glaucoma

- Fresh vessels of blood may grow in the anterior portion of your eye (iris) & obstruct the usual circulation of blood out of eye, leading pressure to accumulate within the eye. Such pressure has potential to injure nerve fibre that delivers pictures via eye to brain.
- Vision loss, DR, edema of macular, glaucoma, or even a conjunction of such disorders may result in complete vision loss, particularly if they are inadequately controlled.[28]

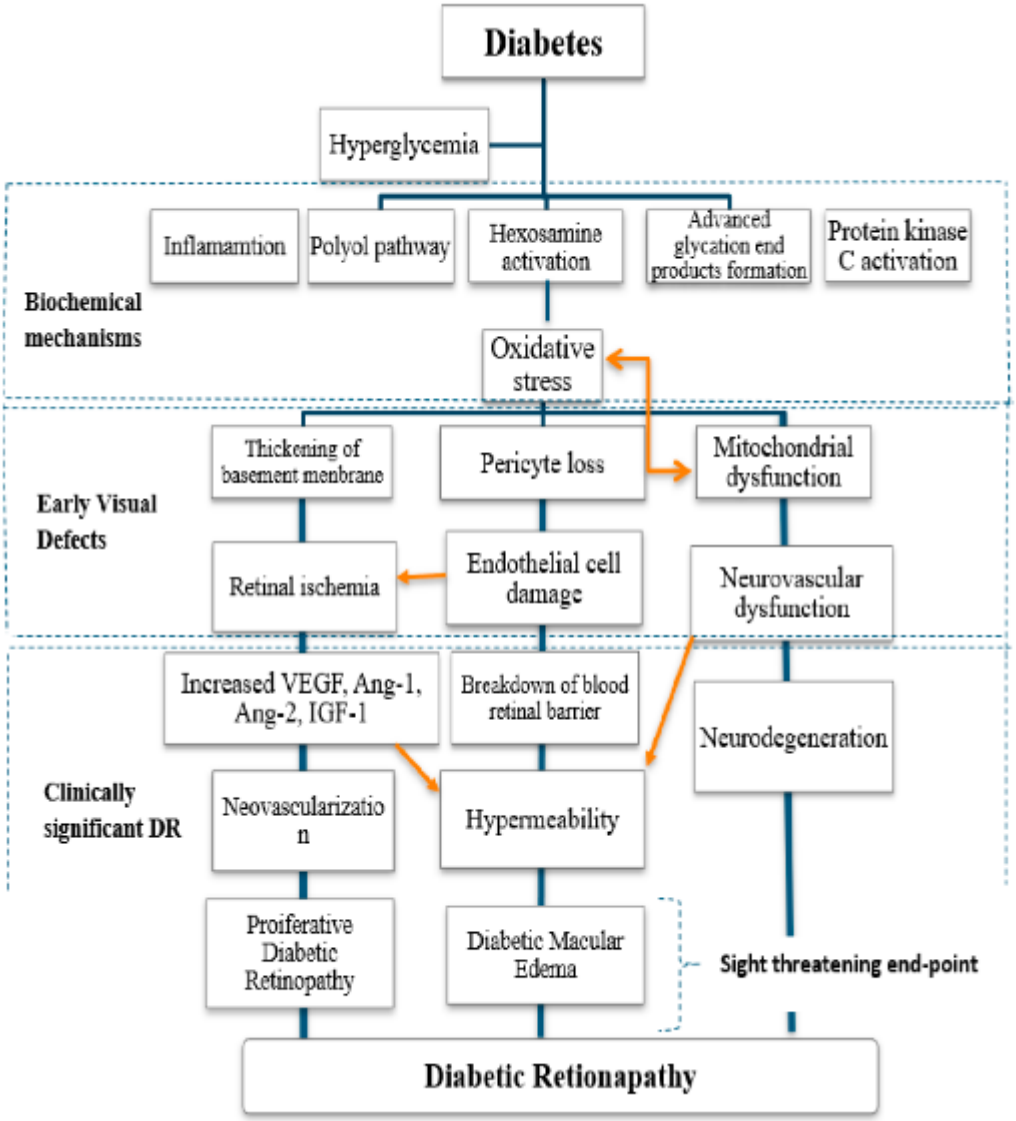
PREVENTION

- Diabetic retinopathy cannot constantly be prevented. Routine eye checkups, appropriate blood sugar, blood pressure management, and early treatments for vision disorders, on the other hand, may help avoid serious vision loss.
- Lower the likelihood of DR by
- Controlling your blood sugar levels
- Keep healthy food and exercise should be regular habit. Each week, strive to acquire minimum of 150 mins average aerobic activity, like walking. Administer diabetes medicines/insulin as directed.
- One might be required for test and monitor level of blood sugar many times each day or even much frequently when you are unwell or agitated. Consult doctor to know how times a day should be tested.
- Take Hba1c test with the physician. HbA1c, often known as the haemoglobin A1C test, examines ones overall level of blood sugar in the time period of 2-3 months before the test.
- Maintain a good lipid and BP level.
- Healthy nutrition, frequent exercise, and decreasing extra weight may all assist. Drug treatment is occasionally necessary too though.
- Either you smoke or take other forms of tobacco, contact doctor for support in stopping.
- Cigarettes raises your risk of getting diabetes problems such like DR.
- Maintain a lookout for alterations in your eyesight.
- If your eyesight changes dramatically or is otherwise blurry, scattered, or foggy, call the eye doctor straight once.[29]

PATHOPHYSIOLOGY

- DR is small vessel disorder defined by increased capillary flow & capillary leak as a result of vasculitis, cell swelling, tissue swelling, integrin expression & interleukins, reactionary glia, intraretinal death of cells, and formation of new blood vessels. Hyperglycemia is involved in the pathophysiology of DR. Elevated glucose flow through the polyol route, AGE result buildup, swelling, & protein kinase C activation are all metabolic mechanisms related to high blood sugars-induced vascular injury (hexosamine pathway)
- Hyperglycemia-induced superoxide excess in the mitochondria induces oxidative stress, that functions as a source of stress, linking each of these metabolic processes. Multiple early clinical characteristics of Diabetic Retinopathy are induced by oxidative stress, along with a thicker basal lamina, pericyte cell death, as well as mitochondrial failure, all of these culminate in BRB breakdown. BRB failure hardens retina while simultaneously raising leukocytosis, which is an intravascular immunological reaction that is one of the earliest clinically evident diseases of DR. This then induces WBCs to abide by endothelial cells covering blood vessels, which influences capillary obstruction and blood vessel leakage

FIG - 6



DR occurs as a consequence of high blood sugars-induced oxidative damage through numerous molecular pathways. According to micro vascular pathophysiology, endothelium degradation induced by pericyte depletion produces decreased perfusion, which results in formation of new blood vessels & affects the BRB's stability. These ultimately progress to eyesight-threatening sites, that are the most severe consequences of Diabetic Retinopathy. Pericytes, in contrast, give mechanical stability to the capillaries; hence, pericyte depletion is related to endothelial cell destruction, along with cotton wool spots, tiny red dots scattered in retina, & dot as well as blot hemorrhages. Furthermore, pericyte depletion and endothelial dysfunction produce capillary occlusion and localized hypoxia, that triggers oxygen deprivation factor 1.

(HIF 1). Following that, stimulation of such a protein stimulates the production of vascular endothelial growth factor (VEGF). Degeneration of neurons is a consequence of high blood sugar-induced dysregulation of many essential neurotrophins, such a NGF, PEDF, IRBP & somatostatin, even though angiogenesis includes its up - regulation about the pro-angiogenic aspects (VEGF, Ang-1, Ang-2), in addition to thrombin growth factor (PDGF) & vasoactive hepatic cells growth regulators. Angiogenesis develops fragile and permeable capillaries, which encourage vitreous bleeding. Repeated haemorrhages result in the creation of fibrous tissue scars & gliosis, further contraction produces vision threatening outcomes like PDR & DME.[30]

DIAGNOSIS

- A full eye examination may be performed to identify diabetic retinopathy. Medical history to assess visual impairments, existence with DM, as well as other basic health conditions that could be influencing sight could all be part of testing, besides a focus on examining the retina and macula.
- Measurements of eyesight can evaluate the level of vision impaired.
- Refraction is used to assess whether a fresh eyeglass adjustment is necessary.
- Evaluation of a ocular structures, including a widened pupil inspection of retina.
- The pressure inside of the eyeball is measured.
- Optic imaging and ct that record the present state of a retina may be required as a additional testing.
- Fluorescein angiography is used to identify aberrant blood vessel growth.[31]

TREATMENT

To regulate your blood sugar, doctor may prescribe medicine such as specific diabetic retinopathy eye drops or oral medication, in addition to lifestyle modifications such as diet and exercise.

TREATMENTS FOR ADVANCED DR

The major therapies to DR that are endangering or harming eyesight are:

- Laser therapy is employed to treat the growth of new blood vessels in the back of the eyes (retina) in instances of PDR, as well as stabilizes certain instances of age - related macular degeneration.
- Eye injections-used to treat serious age - related macular degeneration that is endangering eyesight.
- In certain instances of diabetic maculopathy, anti-VEGF injections could be given right into the eyes help avoid angiogenesis from developing at the rear of the eyes.
- The major drugs have are ranibizumab & aflibercept, which may help prevent your eye issues from worsening and may even improve vision.
- Steroid eye implants may be used to treat severe maculopathy if eye injections are unsuccessful.

- If anti-VEGF injections are not an option or do not work, one may be offered an intravitreal implant (brand name Ozurdex) containing a steroid medicine called dexamethasone. This is a small implant that is inserted into eye using a specific applicator. To numb eye, a local anesthetic will be provided initially.
- Over the course of many months, the implant gradually releases dexamethasone. This decreases swelling in eye and may help restore eyesight; the implant ultimately dissolves and does not need to be removed.
- Eye operation - can eliminate bleeding and scarred tissues from the eyeball whenever laser therapy isn't really viable owing to progressive retinopathy.[32]

DIABETIC NEPHROPATHY

- DN is a chronic condition that includes following symptoms
- DN is a chronic condition that includes following symptoms minimum two distinct events 3 to 6 months difference.
- The rate of glomerular filtration (GFR) is steadily dropping
- Elevated arterial BP
- DR occurs as the most frequent reason for CKD in US and some other Western nations today. This is now one of the biggest devastating long-term consequences in both mortality and morbidity in diabetic people. DM accounts about 30 to 40% of all instances of final stage renal disease in US.
- Atypical presentations of DN having separation of protein in urine with impaired kidney function have lately garnered attention.
- It must also be emphasized that microalbuminuria does not necessarily predict DN. Nonetheless, the majority of DN patients have protein in urine, that worsen as the illness develops and therefore is always accompanied by hypertension.[33,34]

Diabetic Nephropathy Prevalence

- DM among adults was expected may climb from 6.4percent (285 million) in 2010 to 7.7percent (439 million) by 2030. This rise would be greatest across developing nations (69%) versus developed nations (20%). More than 90 percent among those diabetics would develop type 2 diabetes. India and China will account for 36% of extra 1540 lakh people who have diabetes.
- A large increase in the prevalence for DM2 with in the upcoming twenty years would significantly raise the risk of DKD, that affects around 1/3rd of patients with DM2. Microalbuminuria is found in 39% of diabetics worldwide. AusDiab, people, reported that the overall prevalence for albumin in urine was 0.83 percent per year. Diabetes patients reported a 3.1% yearly incidence of albuminuria. Diabetic Nephropathy is currently the leading source of the ESRD in the world, causing nearly a third of all cases. It is demonstrated by the situation in Australia, in which the number of patients starting dialysis for DM2 grew fivefold between 1993 and 2007. DKD will have significant financial impacts, also for ESRD therapy as well as the concomitant macrovascular complications of Diabetic Neuropathy. Currently, the yearly cost of treating ESRD in DM2 people in the US is predicted to reach USD 39.35 billion in

2010, up from USD 16.74 billion in 1998 . Some ethnicities in developed countries, such as Native Americans, African-Americans, and indigenous Australians, have a greater frequency of ESRD attributable to diabetes. The issue is that the nations and communities most hit by the DN pandemic will be the ones least able to shoulder the expenditures.[35]

SYMPTOMS

There may be no symptoms at early stages of diabetic nephropathy. In later stages patient may experience

- BP regulation is worsening.
- Proteinuria
- Edema of eyes, hands, ankles or feet.
- Excessive urination Needed lower insulin and diabetic medicine
- Confusion or trouble focusing
- Shortness of breath
- Appetite loss
- Nausea and vomiting
- Consistent itching
- Fatigue

RISK FACTORS

- Factors that can increase risk of DN while having diabetes include:
- Hyperglycemia (uncontrolled high blood sugar)
- Having high blood cholesterol
- Obesity
- Family history of diabetes and renal diseases [36]

PATHOPHYSIOLOGY

- SVD initiates pathogenesis. The process is complicated, necessitating protein glycosylation impaired hormonally by releasing of cytokines
- [eg. Tg β, mesangial matrix Sludging hemodynamic changes in glomerulus over filtration. an initial prior functional/practical deformity, Is alone a corresponding medium of renal failure evolution
- Glycation of glomerular proteins is caused by hyperglycemia, which is accountable for mesangial cell augmentation, matrix precipitation, and destruction of vascular endothelium.
- Traditionally the basement layer of glomerulus thickens
- Plesions of disperse (or) nodular intercapillary sclerosis of glomerulus are varied. The spots of glomerulus sclerosis are Kimmelstiel-wilson letions. There are efferent & afferent arteriole hyalinosis, in addition Sclerosis of arteries / BV, Interspatial fibrosis & tubular deterioration exists. Mesangial matrix enlargement alone visible to be relate the progession of kidney disease to the end stage.

- DN starts with Over Filtration of glomerulu.GFR comes to normal Value with early kidney impairment & light HTN, where that substandard over longer periods. Microalbuminuria or elimination of urinary albumin ranges from 30 - 300 mg/day occurs . As observation of protein in urine by dipstick on regular urine analysis generally needs 7300 mg albumin/day.
- urinary albumin at this condition is referred to as Microalbuminuria. Microalbuminuria usually proceed to macroalbuminuria. on average, nephrotic syndrome pprogressestend-stage kidney disease by 3 to 5yrs.
- Alternate UT deformities associated with DN may hasten renal function declination comprise papillary necrosis, the kidneys in DN might be usual or increase in size.

STAGES

DN is traditionally described as progressing by 5 by different clinical phases. They are Categorized based on GFR, urinary elimination of albumin & systemic arterial BP Values.

Stage-1

- Normoalbuminuria & normotension characterize this stage. The glomeruli become hypertrophied in all diabetic patients, resulting in a inclined/elevated filtration surface area. Furthermore, Glomerular bloodflow & trans- glomerular hydraulic push dissimilarities has been found to be inclined. These factors cause an elevation in GFR- that is 20% to 40% higher than normal
- Remarkably great elevation in GFR (<7 than 150ml/min/1.73m²) araise in approximately 1/3rd of Juvenile DM patients & appears to be correlated with better glucose sugar control. In T2DM, over-filtration is either absent or greatly reduced, while it is still debatable, over-filtration is Considerably linked to the succession of DN. Statistical analysis of concurrent studies in Juvenile DM found that Subjects with over filtration had a 2.711. Higher risk for developing at least Microalbuminuria than those with normofiltration. The GFR study investigators discovered similar results. The dynamite proportion for amelioration to a slightest of microalbuminuria in their study of Type 2 DM subjects 2.16. They discovered that 23.4% of subjects are insistent over filtration and developed macro/microalbuminuria, collate to 10.6% of Subjects with High filtration that has taken half of the year to be upgraded

Stage - 2

- Microalbuminuria / Micro albumins in urine elucidated as a UAE 30 - 300mg/day or 20-200g/min, able to evolve in 20-40% T1DM /Easily onset DM after the first, 5yrs of disease. Microalbuminuria can be found in 20-40% of T2DM / Late onset DM during the Period of detection. In Type 1 & 2 subjects, elevated sugan values, increased BP & inclined BMI are seen & are not individualistic of risk elements for evolution of Micro albuminuria. The tubular & Glomerular basement layers go on with stiffening structurally, it shows evidences of loss of podocytes. Mesangial matrix enlargement & disperse sclerosis to glomerulus can occur. Before investigation recommended /

Indicated that around 80% of T1DM Subjects advances from albumin in urine to Protein in urine at an end of 6-14 years.

- This has recently been estimated to be close to 40%. These findings could be attributed to better glycemic & hypertensive control over time, as well as expansive use of RAAS inhibitors in micro albuminuric subjects. It further claims that microalbumin in urine doesn't always predict macro albumin in urine in DM subjects. Concurrently, Progressive mesangial expansion reduces the possible glomerular expanse for clarification and correlates conversely with recessing GFR.
- In this stage, HTN is instant & aggravates the BP regulation, as faster the GFR downtown.

Stage 3

- As the glomeruli inaugurate manifesting diffuse or nodular sclerosis of glomerulus, as a result greater deficit of podocytes proceeds. Large amount of proteins is eliminated by urine greater than 500mg/dl or UAE appear greater than 300mg/dl. It is noticed following 15 years of DM in type-1 Elimination of protein in urine is a self-determining risk element for advanced aggravation of kidney failure. The gradual accretion of Mesangial matrix Causes decreased Surface area for purification by glomerulus that contrarily affiliate with reducing GFR. HTN is most significant comorbidity that aggravates BP regulation and quickly decreases the GFR.

Stage 4 & 5

- They are the last stage of DN. Subjects who are not treated may develop nephrotic range protein in urine. GFR decreases at a range of 1ml/min/month as far as ESRD occurs, where a Point Kidney replacement remedy is required. It should be noted, however, that this time course varies greatly between subjects. The ordinary period from type 1 DM interpretation to ESRD progression is 20-25 years, along with a further quick course progressing in subjects with uncontrolled HTN & high proteinuria.

Diagnosis

- The Urinary albumin test is one example of a routine screening test
- examination determine albumin in urine. In most Cases, kidneys do not purify albumin from a fluid connective tissue. A high degree of protein in urine illustrates impaired renal function
- Albumin creatinine ratio/proportion
- A chemical waste product purified out of blood by healthy kidneys is creatinine. Further signal of renal function is albumin and creatinine in urine sample was collated.
- GFR - To estimate the time taken by kidneys to purify blood Cr values is used. A less purification rate indicates the abnormal functioning of kidneys.
- Further interpretation tests that can be performed comprise.
- Imaging Examination using X-rays & ultrasounds in order to evaluate morphology of kidneys. CT and MRI may also be needed to evaluate the circulation of blood in kidneys.

- Other examinations may be utilized based on different cases.
- Biopsy of the Kidney
- A small sample piece of kidney tissue is collected by administering local anesthesia then extract a piece of kidney tissue with a thin needle for auditing beneath the microscope.[37]

Management

- The initial step towards managing DN is managing the DM and HIN through dietary changes. Conduct modifications, and exercise & by following prescription one can avoid renal deterioration & additional complexity by controlling blood sugars & hypertension
- Medications/Prescription
- During fundamental stage of DN following medications are prescribed.
- BP management: HIN is managed with ACE inhibitors & ARBS
- Hyperglycemia management.
- Metformin increases insulin perceptiveness although increasing glucose manufacture in liver. GLP-1 receptor agonists decline blood glucose value by leisuring digestion & increasing insulin exudation in counter to inclined sugar levels. SGLT2 inhibitors reduce the retaliate of glucose to blood, resulting in multiplying urine glucose elimination.
- Excessive cholesterol levels: statins are drugs which lower cholesterol & are accustomed to manage high levels of cholesterol and declining protein amount in urine.

Diabetic nephropathy management in chronic stages

- A kidney transplant may be recommended by your physician/management patterns aimed at either replacing kidney function. Amongst them, kidney dialysis is one option.The above procedure fitters the debris including excess flowing substances.Hemodialysis & peritoneal dialysis were the the 2 main procedures. Firstly the most frequently used procedure it is required for the subject to go to the hospital/place where the dialysis machine is present.
- The procedure takes three to five hours of time. The procedure can also be conducted at 2nd residence
- Management of sickness / indications.
- If the subject refuses the procedure of dialysis the life span reduces
- The therapy may be given to make the patient feel comfortable [38]

CAD

- This is a multifactorial disease in which the blood flow is decreased in a few of the blood capillaries that surround the heart. This condition can exist as localized or widespread. Aside from the rarely occurring congenital abnormalities, it is typically a deteriorative condition that is not common in subjects whose age is below thirty and prevalent in patients under the age of sixty.

- It is almost source of reduced life span, sickness & hospital expenses. CAD is responsible for approximately 1 out of 6 deaths in USA along with around 34% of subjects who experience a coronary attack. & of patients particularly undergone through myocardial infarction may undergo death within a year. In 2007, the most recent year for which data is available, CAD is responsible for 1.7 million hospitalizations and 1.2 million in patients percutaneous coronary intervention procedures, with a total cost (direct & indirect) of 177.5 billion.
- Patients who have had a coronary event or the ones having possibility to get recurrent attacks or even death. Improving medication is necessary to prioritize the community's healthy. According to AHA. Dual antiplatelet therapy is required by the American college of Cardiology (ACC) for secondary prevention of CAD.[39]

PATHOGENESIS

- The indication of pathogenesis of CAD is progression of atherosclerotic plaque. It is development of fatty substance which can taper the vessel lumen thus obstruct the blood circulation.
- Forming of a fat layer occurs at the beginning of the procedure. The connective tissue below the endothelial layer consists of deposits of triglyceride fat containing phagocytes/ Scavenger cells which are called foam cells which lead to the forming of fat layer;
- During cardiovascular injury, tearing of the innermost membrane called as tunica intima occurs where the phagocytes (scavenger cells), in immature state move towards the tissue space below the endothelial layer and gets matured to perfect phagocytes otherwise called as scavenger cells. These cells suck up bad cholesterol bits that has been bombarded by free radicals and form foam cells. T lymphocytes gets switched up and the chemokines get discharged solely to help the whole pathology. The discharged chemokines alert up the involuntary muscles absorbing the bad cholesterol bombarded by the free radicals and the. protein in the body called collagen and puts them with alerted phagocytes, due to which the population of the foam cells gets increased. Hence the formation of atherosclerotic layer in the sub endothelium occurs.
- If the monolayer of the endothelial cells is not damaged to a greater extent, the atherosclerotic layer can grow larger and can set off as strongly solidified forms and these abrasions gets calcified further and looks like fibrous cap.
- Further the abrasions hemodynamics can be significant which leads to inadequate blood supply to the myocardial group of cells. At times when there is demanded requirement of blood from the myocardium it results in chest pain. During the relaxed state, the indications may recede due to the reduced demand of the oxygenated blood supply. Few of the atherosclerotic layers may get ruptured, revealing platelet -III/ CD142 which is a protein encoded by F3 gene which results in blood clot/ Embolism. Based on the extremity of the cardiovascular injury this blood clot the outcome be subtotal lumen occlusion leading to ACS, NSTEMI OR STEMI[40,41]

Classification of CAD –

1. Stable Ischemic Heart Disease (SIHD)
2. Acute Coronary Syndrome (ACS) ·

- ST-elevation Myocardial Infarction (STEMI)
- Non-ST elevation Myocardial Infarction (NSTEM])
- Unstable Angina

Disease of the stable ischemic heart

- It is a therapeutic ailment characterized by reversible mismatches in cardiac infarction, oxygen command, and stock prompted by the insufficient blood circulation to the myocardium
- Disease of the acute coronary heart[42]

STEMI

- ST acclivity MI is a severe form of heart attack where a patient's vital blood vessels become obstructed.
- A deformity ascertained on the 12th lead ECG is ST segment acclivity.
- Subjects undergoing acute STEMI are endangered of evolving mortal arrhythmias such as ventricular fibrillation which can lead to abrupt cardiac arrest known as a massive heart attack. Such subjects need CPR and defibrillation which is a shock to reinstate a usual heartbeat.
- Characterized by angina attacks or angina equivalents like substantial heartache that spread to the left arm
- (eg: hyperventilation, giddiness, tiredness)
- Generally caused by strain, spiritual enthusiasm, or a binge meal and is frequently exacerbated in frosty temperatures.

NSTEMI

- NSTEMI is defined as either a complete blockage of a small coronary artery or a limited obstacle of a large coronary artery. The clinical presentations are indistinguishable from STEMI but the chances of the destruction of the heart are low.
- Earlier ECG manifests ischemia swap like ST declination, T wave manifestations, or transient ST inclination but, could further be typical or display unspecified changes. If the patient has continuous ST inclination, verification of posterior MI, or current left bundle branch block, the diagnosis should be ST inclination MI.
- As a result, NSTEMI encloses a wide range of ischemia injuries to the middle layer of the heart as indicated by troponin acclivity. Normal serial troponin distinguishes it from unstable angina pectoris.

UNSTABLE ANGINA

- Unstable angina leads to anticipated heart pain during a relaxed state. The leading reason is decreased blood circulation in coronary arteries, which can burst and cause wounds to the coronary arteries. This causes blood coagulation which prevents blood circulation to the heart.

Symptoms

Patients may experience a variety of symptoms if the heart does not receive enough arterial blood.

- Chest pain
- Massiveness
- Solidity
- Blazing
- Squashing

These clinical presentations can be confused with heart biasing or dyspepsia

Further symptoms include

- Pain in the upper limb, shoulders
- Sweating and breathlessness
- Lightheadedness[49]

Risk Elements

- Elevated BP
- High cholesterol level in the blood
- Being obese
- Preeclampsia during pregnancy
- Tobacco smolder
- Ethanol intake
- Emotional upset
  The risk of CAD rises with age. Males have a higher risk at the age of 45, while females start to have a higher risk at 55. Family history of CAD have a higher risk of occurring in an individual.[50,51]

Diagnosis:

- Past health history
- General examination
- Others are required to diagnose CAD. Among these types ECG amplifies the electrical signals which travels by heart. It helps in adjudicating heart attack.
- ECG- this test creates a picture of using ultrasound waves. The reports conclude the proper activity of heart.

- Stress test: This test appraises stress on heart while physical action. It evaluates electrical function of heart during exercise. We can use assured drugs in place of physical action for testing those who are incapable to exercise.
- Cardiac Catheterization: This procedure involves insertion of a catheter through an artery into groin or wrist and inoculates a special coloration into coronary arteries. This helps in determining the blockages.
- Heart CT Scan: This imaging test is used to check calcium deposits in blood vessels.[43]

Ischemic strokes –

- These are prevalent / popular. It arise at the time where blood vessels in brain turn narrowed or Impeded leading to desperately dwindled blood flow. Blood clots and additional travel via the blood flowing through the circulatory system, frequently from the heart and lodge in the blood vessel in brain instigated to confined blood vessels.

Symptoms –

- This happens quickly, within a fraction of time & therapeutic alertness is required. If a person cognizance a spare of these symptoms pursue support shortly.
- Abrupt apathy of face, limbs, specifically one side of body. Abrupt bewilderment, Abrupt difficulty to expressing, Abrupt difficulty in vision
- Having abrupt difficulty wandering.
- Sudden vertigo, deficit steadiness or collaboration.
- Acute Ischemic stroke can lead to further symptoms in women
- Pain in face, upper & lower limbs.
- Hiccoughs, queasiness, palpitation, chest pain
- Breathing problems.

Risk Factors

- Multiple element agents can elevate and threat of owning a stroke.
- Risk factors associated with one's way of life
- obesity or being overweight, lethargy. Heavy drinking of alcohol
- Administration of illicit drugs like cocaine & methamphetamine.
- Smoking, disclosure to second hand smoke
- High BP
- High cholesterin, TG's level
- Covid 19 infections -personal/genealogical history/ hereditary or stroke, TIA

Diagnosis

- like concentrating on heart & checking BP. An audiovisual assessment will although accomplished to determine how a potential stroke is affecting nervous system.
- Phlebotomy are performed

- Numerous Phlebotomys possibly performed to determine how hastily blood coagulation occurs, even blood glucose is very high or low and even having any contamination.
- CAT scan stands for computerized axial tomography
- A CT devises a clear picture of brain by utilizing a series of x-rays.
- CT can disclose brain hemorrhage, ischemic stroke, tumor & additional conditions. A coloration is inoculated into blood stream to better visualization of blood vessels.
- ECG construct figure of heart utilizing acoustic waves
- ECG can determine the position of clots in heart that had traveled to brain & Prompt a stroke
- Angiogram of brain -
- uncommon test, delicate pipe over the large arteries & into carotid or vertebral artery through a small incision in the groin. The capillaries are then dyed to make them noticeable beneath X-ray.
- This conduct/method regulates a close up glimpse of arteries in brain & neck.
- USG of carotid arteries: acoustic wave establish intricate illustration of inward carotid arteries.in neck all along the test. This text ascertain plaques and movement of blood in carotid arteries.
- MRI composes a copy of brain by utilizing dynamic radio waves & magnetic flux.MRI can perceive brain tissue that is antiquated and damaged by ischemic stroke & hemorrhages. To look arteries & veins we need to inoculate a coloration into a blood vessel.[44]

TRANSIENT ISCHEMIC ATTACK

A transient ischemic attack (TIA) is a medical emergency. It is defined as a transient episode of neurologic dysfunction due to the focal brain, spinal cord, or retinal ischemia, without acute infarction or tissue injury. The definition of a TIA has moved from time-based to tissue-based. A TIA typically lasts less than an hour, more often minutes. TIA can be considered as a serious warning for an impending ischemic stroke; the risk is highest in the first 48 hours following a transient ischemic attack. Differentiating transient ischemic attack from other mimicking conditions is important. Transient ischemic attacks are usually associated with a focal neurologic deficit and/or speech disturbance in a vascular territory due to underlying cerebrovascular disease. It is always sudden in onset. Evaluation of TIA should be done urgently with imaging and laboratory studies to decrease the risk of subsequent strokes. The subsequent risk of TIA or ischemic stroke can be stratified with a simple clinical measure.

SIGNS AND SYMPTOMS

Transient ischemic attacks usually last a few minutes. Most signs and symptoms disappear within an hour, though rarely symptoms may last up to 24 hours. The signs and symptoms of a TIA resemble those found early in a stroke and may include sudden onset of:

- Weakness, numbness or paralysis in the face, arm or leg, typically on one side of the body
- Slurred or garbled speech or difficulty understanding others
- Blindness in one or both eyes or double vision
- Vertigo or loss of balance or coordination[45]

OBJECTIVES

- To identify age & gender that are causing vascular complication
- To assess the most likely occurring vascular complication among males & females
- To assess the most likely occurring vascular complication in CAD among males & females
- To identity which age group is most commonly exposed to vascular complication
- To assess the onset of dm where vascular complications are developing more commonly in both genders.
- To assess the HbA1C range where the subject's exposure to complication is high.
- To assess the cholesterol levels where exposure to the complication is greater.
- To create awareness among the diabetic population
- To educate the people regarding the vascular complications of Diabetes.

NEED FOR STUDY

- A Vascular complication is referred as a condition that effects the blood vessels. Vascular complications are most frequently noticed in diabetic population when compared to non-diabetics.
- The goal of the study is to observe the different vascular complications. How HbA1C range & onset of DM triggering the vascular complications in both males & fem ales and to know the most frequently developing vascular complication. Thus, educating people and creating awareness among diabetic subjects by providing knowledge related to vascular complications.
- Proper regulation of DM and other comorbidities like HTN, CKD, and avoiding social risk factors like intake of alcohol, smoking, following proper healthy, balanced diet, maintaining a healthy body weight and , regular exercise can decrease the occurrence of complications, disability and death

METHODOLOGY

STUDY SITE:

The study was conducted in the KIMS-SUNSHINE Hospital, Secunderabad

STUDY PERIOD:

The period of study was 6 months

STUDY DESIGN:

Case study was a prospective and observational case sheets study.

SAMPLE SIZE:

Total 200 Cases were incorporated in the study and were followed for prospective observational study of Vascular complications in diabetic population

STUDY APPROVAL:

The ethical Committee at KIMS-SUNSHINE Hospital, Secunderabad had been approved study protocol and written informed consent

STUDY CRITERIA: Study criteria includes in-patients who were developed Vascular complication with existing comorbidity as diabetes

INCLUSION CRITERIA:

- Adult Subjects with diabetes
- Only Inpatient
- Both Females and males
- Patients with Vascular complications are included
- patients who are admitted in hospital for at least 3 days

EXCLUSION CRITERIA:

- Pregnant & Lactating
- Subjects who unwilling to give consent
- Bed ridden subjects.
- Pediatrics

SOURCE OF DATA COLLECTION:

STUDY MATERIALS:

- Patient consent form
- Patient data collection forms.
- Data collection form.
- Patient information leaflets.

Patient consent forms:

It contains demographic details of patients, purpose of study and brief detailed explanation of the study with in English, Telugu and Hindi and is used to obtain consent of the patient.

Patient data collection forms:

It captures patient demographic details like name, age, sex, date of admission, date of discharge, complaints on admission, medical history, medication history, social history. family history, previous allergies and it includes physical examinations, provisional diagnosis, final diagnosis, progress chart and medications.

Patient's information leaflets:

It contains all the basic data regarding the diabetes, signs and symptoms of person

having diabetes.

SOURCES OF DATA:

Patient data relevant to the study was collected from the following sources Inpatients: Patient case records, medication charts and lab reports.

STUDY PROCEDURE

The current study had been conducted in KIMS Sunshine Hospital. It is a prospective observational study. Data was gathered from Case sheets of patients who are willing to participate in the study after acquiring the consent. The complete information needed for the study is filled in the patient data collection form which has been proposed for the project.

We registered 200 subjects for the study. Questions has been asked to the patient regarding the onset of diabetes, onset of vascular complications, food habits and comorbid conditions.

The data which is obtained is entered into excel and results has been calculated. The study was conducted in In-patient departments which include, Cardiology, Nephrology, Neurology of KIMS - Sunshine hospital, Secunderabad, which is a 500+ bedded Multi-super Speciality tertiary care Hospital. 200 patients were randomly registered into the study based on study criteria. Subjects from psychiatric patients, lactating mothers and pregnant mothers, bedridden patients were excluded from the study. The records of patients from the in-patient wards of the selected departments of the hospital were obtained. A total of 200 diabetic patients are diagnosed with vascular complications.

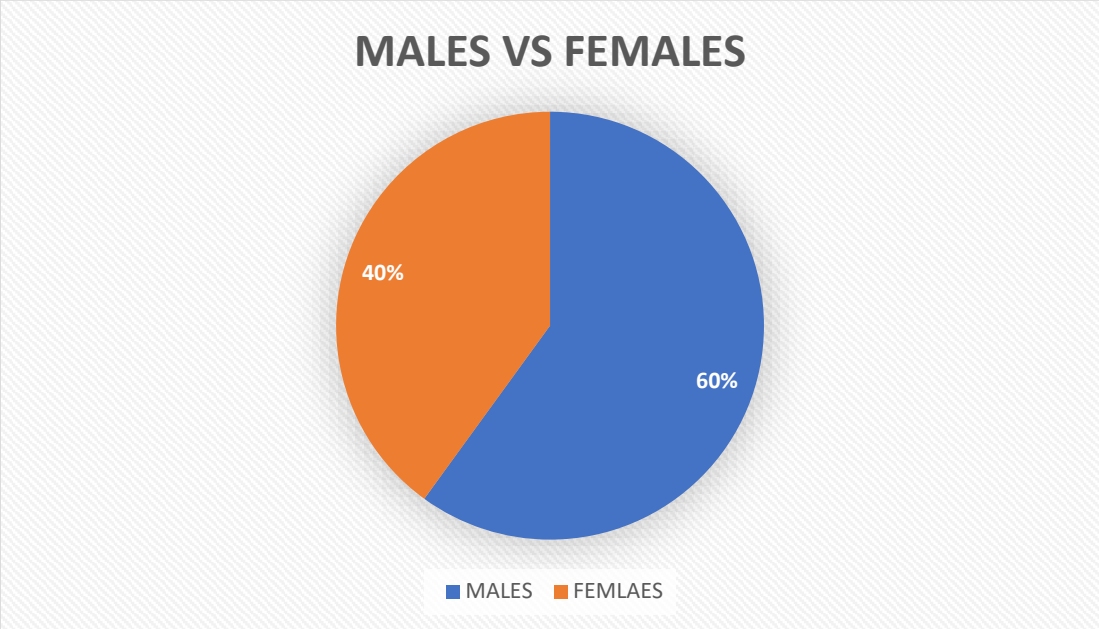
Microsoft word & excel have been used to generate tables & graphs. After the collection of data, it was analyzed for statistical significance. Data were analyzed using descriptive statistics namely mean, total numbers, regression, and percentage.

The format provides the following information.

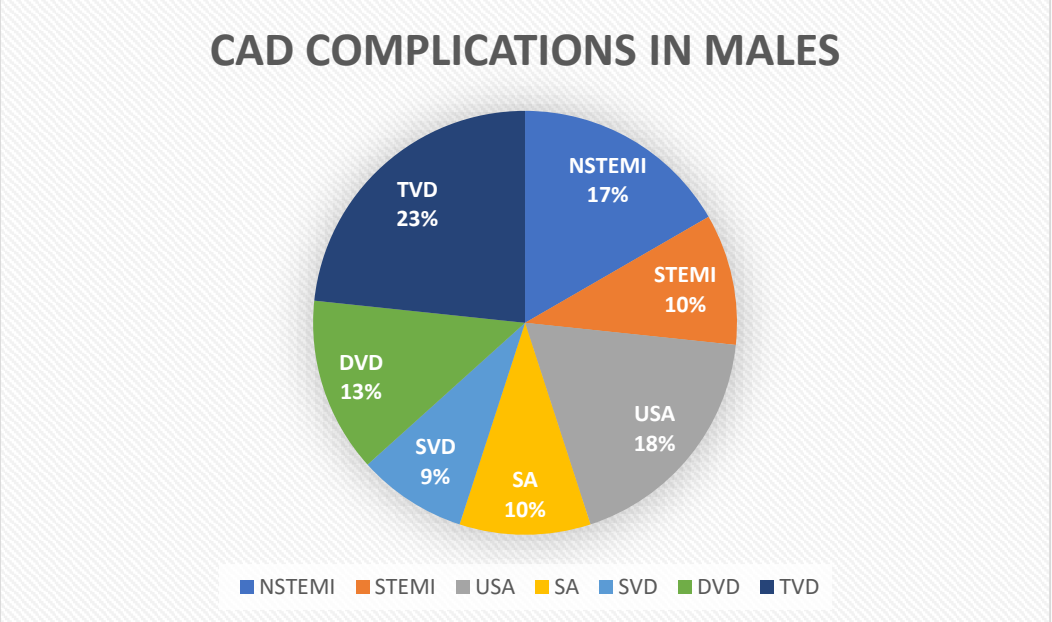
RESULTS

A total of 200 cases were collected in the departments of cardiology, neurology and nephrology in KIMS SUNSHINE HOSPITALS SECUNDERABAD for a period of six months.The following evaluation was made from the obtained data.

PIE CHART - 1



PIE CHART - 2

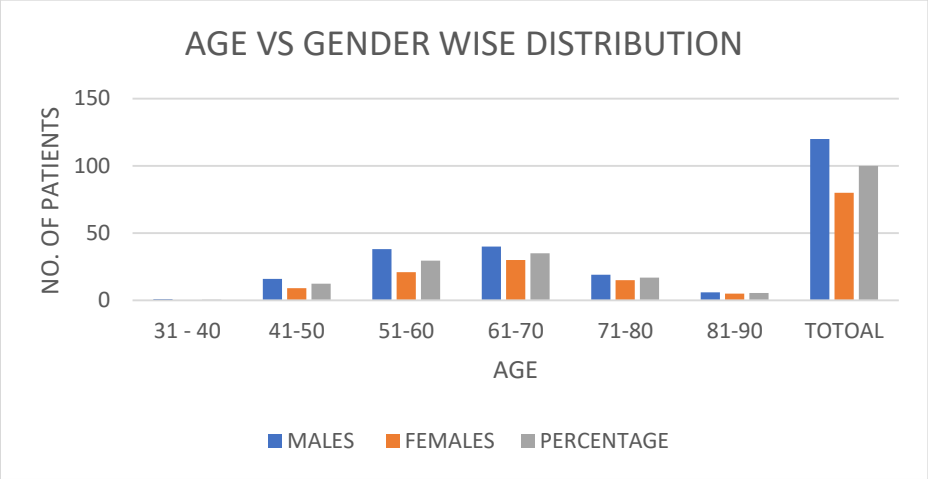


AGE VS GENDER WISE DISTRIBUTION

TABLE – 3

AGE	31-40	41-50	51-60	61-70	71-80	81-90	TOTAL
MALES	1	16	38	40	19	6	120
FEMALES	0	9	21	30	15	5	80
PERCENTAGE	0.5%	12.50%	29.5%	35%	17%	5.5%	100%

GRAPH - 1



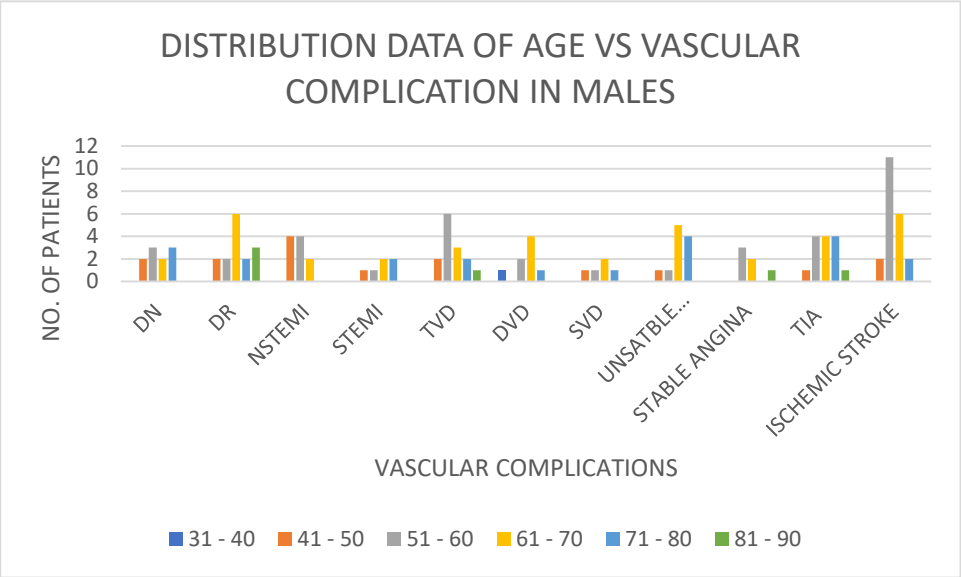
In our study, it was observed that more male subjects are admitted. Out of total 200 subjects 120 were males & 80 were females followed by age group 61 – 70 years are more in both males (40) & females (30).

DISTRIBUTION DATA OF AGE VS VASCULAR COMPLICATIONS IN MALES

TABLE - 4

VASCULAR COMPLICATION	AGE					
	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 - 90
DN	0	2	3	2	3	0
DR	0	2	2	6	2	3
NSTEMI	0	4	4	2	0	0
STEMI	0	1	1	2	2	0
TVD	0	2	6	3	2	1
DVD	1	0	2	4	1	0
SVD	0	1	1	2	1	0
USA	0	1	1	5	4	0
SA	0	0	3	2	0	1
TIA	0	1	4	4	4	1
ISC	0	2	11	6	2	0
TOTAL	1	16	38	38	21	6

GRAPH - 2



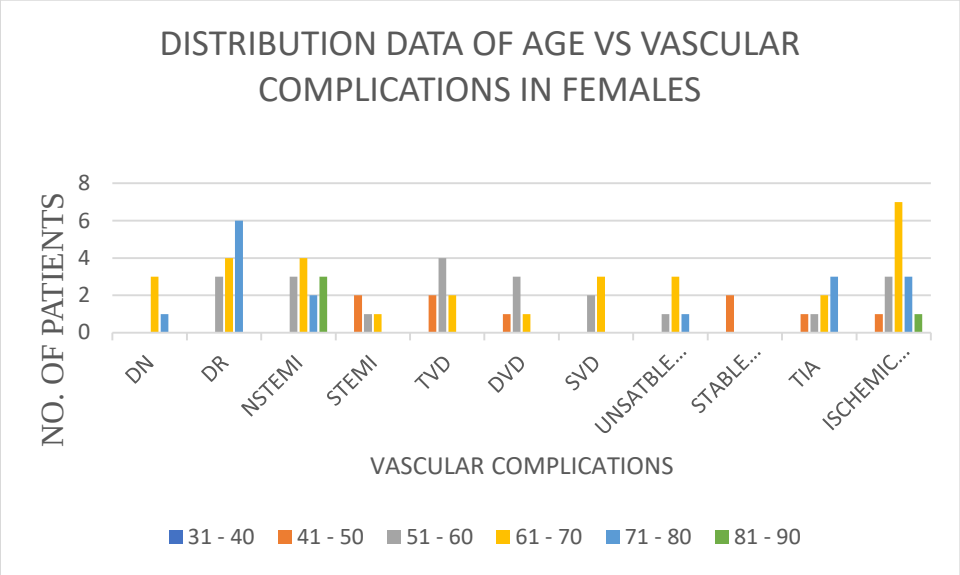
In our current study out of total of 200 participants 120 were males. Among them, majority of them developing ICS (21) compared to other complications and the complications are occurring more likely in age group of 51 – 70 years (76).

DISTRIBUTION DATA OF AGE VS VASCULAR COMPLICATIONS IN FEMALES

TABLE - 5

VASCULAR COMPLICATION	AGE					
	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 - 90
DN	0	0	0	3	1	0
DR	0	0	3	4	6	0
NSTEMI	0	0	3	4	2	3
STEMI	0	2	1	1	0	0
TVD	0	2	4	2	0	0
DVD	0	1	3	1	0	0
SVD	0	0	2	3	0	0
USA	0	0	1	3	1	0
SA	0	2	0	0	0	0
TIA	0	1	1	2	3	0
ISC	0	1	3	7	3	1
TOTAL	0	9	21	30	16	4

GRAPH - 3



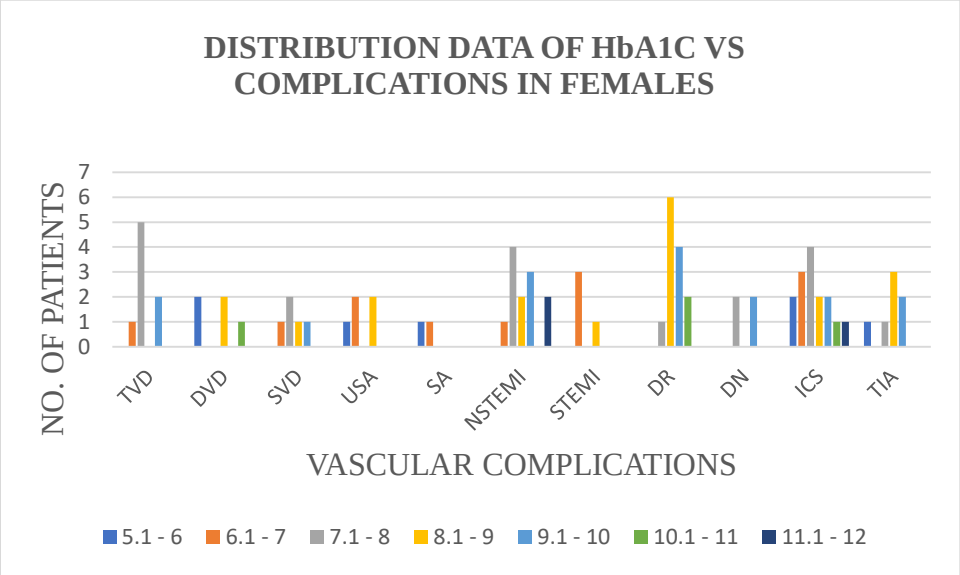
In our current study out of a total of 200 participants, 80 were females. Among them, majority of them developing ICS (15) compared to other complications and the complications are occurring more likely in age group of 61 – 70 years (30).

DISTRIBUTION DATA OF HbA1C VS COMPLICATIONS IN FEMALES

TABLE – 6

VASCULAR COMPLICATIONS	HbA1C						
	5.1 – 6	6.1- 7	7.1 – 8	8.1 – 9	9.1 – 10	10.1 – 11	11.1 – 12
TVD	0	1	5	0	2	0	0
DVD	2	0	0	2	0	1	0
SVD	0	1	2	1	1	0	0
USA	1	2	0	2	0	0	0
SA	1	1	0	0	0	0	0
NSTEMI	0	1	4	2	3	0	2
STEMI	0	3	0	1	0	0	0
DR	0	0	1	6	4	2	0
DN	0	0	2	0	2	0	0
ICS	2	3	4	2	2	1	1
TIA	1	0	1	3	2	0	0
TOTAL	7	12	19	19	16	4	3

GRAPH - 4



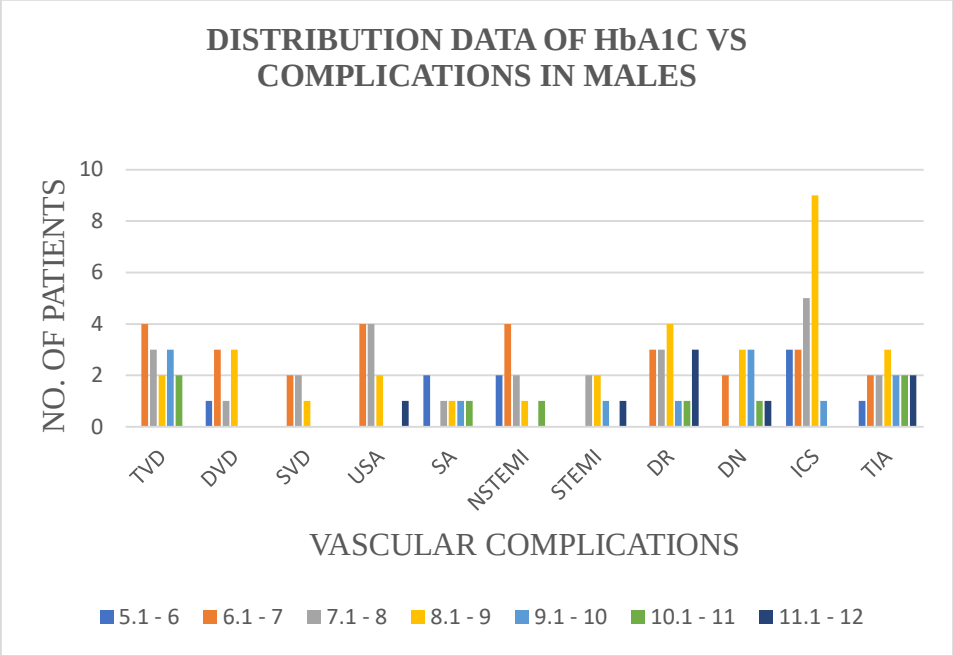
In the present study out of 200 subjects 80 were females among them majority of subjects developing vascular complications at the HbA1C range(38) 7.1 – 9.0 %.

DISTRIBUTION DATA OF HbA1C VS COMPLICATIONS IN MALES

TABLE – 7

VASCULAR COMPLICATIONS	HbA1C						
	5.1 – 6	6.1- 7	7.1 – 8	8.1 – 9	9.1 – 10	10.1 – 11	11.1 – 12
TVD	0	4	3	2	3	2	0
DVD	1	3	1	3	0	0	0
SVD	0	2	2	1	0	0	0
USA	0	4	4	2	0	0	1
SA	2	0	1	1	1	1	0
NSTEMI	2	4	2	1	0	1	0
STEMI	0	3	3	4	1	1	3
DR	0	2	0	3	3	1	1
DN	3	3	5	9	1	0	0
ICS	1	2	2	3	2	2	2
TIA	0	0	2	2	1	0	1
TOTAL							

GRAPH - 5



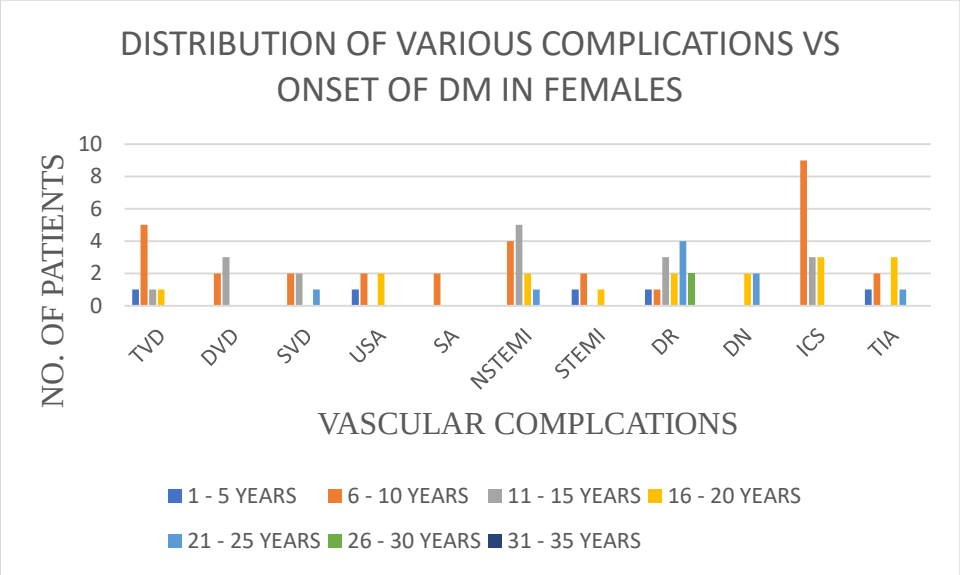
In the present study out of 200 subjects 120 were males among them majority of subjects developing vascular complications at the HbA1C range(31) 8.1 – 9.0 %.

DISTRIBUTION OF VARIOUS COMPLICATIONS VS ONSET OF DM IN FEMALES

TABLE - 8

	1-5 YEARS	6-10 YEARS	11-15 YEARS	16-20 YEARS	21-25 YEARS	26-30 YEARS	31-35 YEARS
TVD	1	5	1	1	0	0	0
DVD	0	2	3	0	0	0	0
SVD	0	2	2	0	1	0	0
USA	1	2	0	2	0	0	0
SA	0	2	0	0	0	0	0
NSTEMI	0	4	5	2	1	0	0
STEMI	1	2	0	1	0	0	0
DR	1	1	3	2	4	2	0
DN	0	0	0	2	2	0	0
ICS	0	9	3	3	0	0	0
TIA	1	2	0	3	1	0	0
TOTAL	5	31	17	16	9	2	0

GRAPH - 6



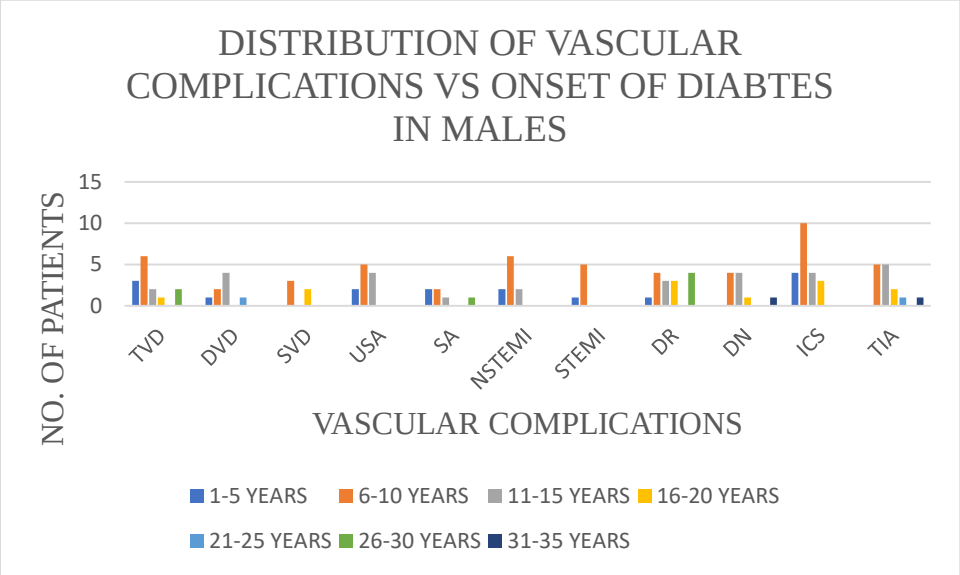
In the present study out of 200 subjects 80 were females among them majority of subjects developing ICS (15), followed by 6 – 10 year (31) of onset of DM.

DISTRIBUTION OF VARIOUS COMPLICATIONS VS ONSET OF DM IN MALES

TABLE - 9

	1-5 YEARS	6-10 YEARS	11-15 YEARS	16-20 YEARS	21-25 YEARS	26-30 YEARS	31-35 YEARS
TVD	3	6	2	1	0	2	0
DVD	1	2	4	0	1	0	0
SVD	0	3	0	2	0	0	0
USA	2	5	4	0	0	0	0
SA	2	2	1	0	0	1	0
NSTEMI	2	6	2	0	0	0	0
STEMI	1	5	0	0	0	0	0
DR	1	4	3	3	0	4	0
DN	0	4	4	1	0	0	1
ICS	4	10	4	3	0	0	0
TIA	0	5	5	2	1	0	1
TOTAL	16	52	29	12	2	7	2

GRAPH - 7



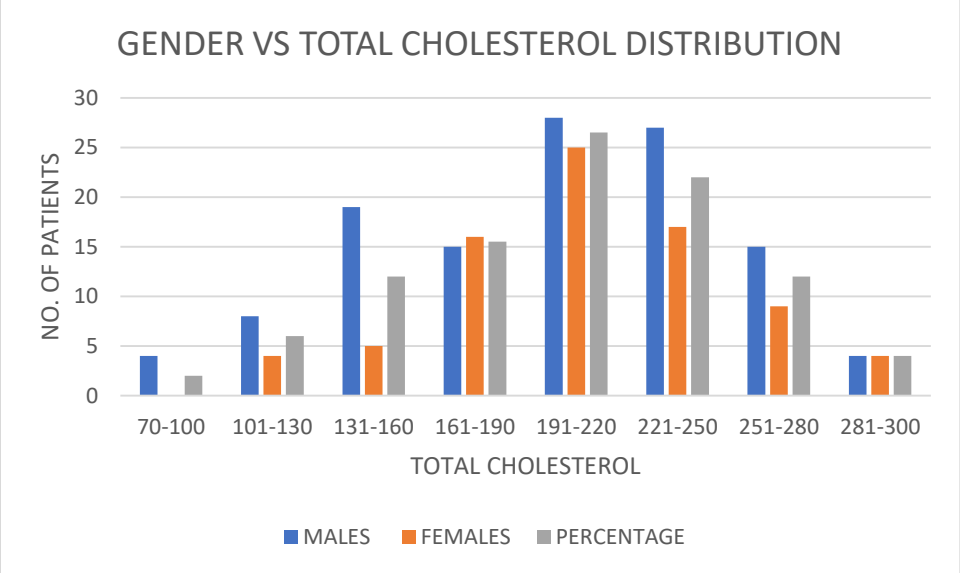
In the present study out of 200 subjects 120 were females among them majority of subjects developing ICS (15), followed by 6 –10 years (52) of onset of DM.

DISTRIBUTION DATA OF GENDER VS TOTAL CHOLESTEROL LEVELS

TABLE - 10

GENDER	70-100	101-130	131-160	161-190	191-220	221-250	251-280	281-300	TOTAL
MALES	4	8	19	15	28	27	15	4	120
FEMALES	0	4	5	16	25	17	9	4	80
PERCENTAGE	2	6	12	15.5	26.5	22	12	4	100

GRAPH - 8



COMPARISON OF ONSET OF DM WITH REFERENCE TO CAD

TABLE - 11

ON SET OF DM	MALES	FEMALES	TOTAL	P-value
1 – 5	11	3	14	P= <0.00001%
6 – 10	29	19	48	
11 – 15	13	11	24	
16 – 20	3	6	9	
21 – 25	1	2	3	
26 – 30	3	0	3	
31 - 35	0	0	0	
	60	41	101	

In our current study out of total of 200 participants 80 were females. Among them, majority of them developing vascular complications at Total cholesterol range of 191-220 mg/dl (25) and least were developed at 101-130 mg/dl and 281-300 mg/dl (4). Out of 120 males majority of them developing vascular complications at Total cholesterol range of 191-220 mg/dl (28) and least were developed 70-100 mg/dl and 281-310 mg/dl (4).

From the above table it was concluded that out of 200 cases, when we Collate onset of DM with CAD, Majority of cases was found in Males(60), where 29 in 6-10 years of onset of DM, 11 in 1-5 years, 13 in 11-15 years, 3 in 16-20 years, 1 in 21 – 25 and 3 in 31 - 35. In females majority of cases was found in 6-10 years of onset of DM i.e, 19, 3 in 1-5 years,11 in 11-15 years, 6 in 16-20 years, 2 in 21 – 25 years. The least number found in both males & females is “zero” in 31-35. when we Collate two values in regression we get p-value (P=0.0001), and is significant. Males with onset of DM 6-10 years are more prone to CAD compared to females.

COMPARISON OF ONSET OF DM WITH REFERENCE TO ICS

TABLE – 12

ON SET OF DM	MALES	FEMALES	TOTAL	P-value
1 – 5	4	0	4	P= <0.00001%
6 – 10	10	9	19	
11 – 15	4	3	7	
16 – 20	3	3	6	
21 – 25	0	0	0	
26 – 30	0	0	0	
31 - 35	0	0	0	
	21	15	36	

From the above table it was concluded that out of 200 cases,when we Collate on set of DM with Ics, Majority of cases was found in Males(21), where 10 in 6-10 years of onset of DM, 4 in 1-5 years, 4 in 11-15 years, 3 in 16-20 years. In females majority of cases was found in 6-10 years of onset of DM i.e, 9, 3 in 11-15 years, 3 in 16-20 years. The least number found in both males & females is "zero" in 21-35. when we Collate two values in regression we get p-value (P=0.0001), thus null hypothesis is accepted and males with onset of DM 6-10 years are more prone to ICS compared to females.

COMPARISON OF ONSET OF DM WITH REFERENCE TO DR

TABLE - 13

ON SET OF DM	MALES	FEMALES	TOTAL	P-value
1 – 5	1	1	2	
6 – 10	4	1	5	
11 – 15	3	3	6	P= <0.00001%
16 – 20	3	2	5	
21 – 25	0	4	4	
26 – 30	4	2	6	
31 - 35	0	0	0	
	14	12	26	

From the above table it was concluded that out of 200 cases, when we Collate on set of DM with DR, Majority of cases was found in Males (14), where 4 in 6-10 years of onset of DM, 4 in 21-25 years, 1 in 1-5 years,3 in 11 -15 years, 3 in 16-20 years. In females majority of cases was found in 6-10 years of onset of DM i.e, 4, 1 in 1 – 5 years,1 in 6 – 10 years, 3 in 11-15 years, 2 in 16-20 years, 2 in 26 – 30 years. The least number found in both males & females is "zero" in 31-35. when we Collate two values in regression we get p-value (P=0.0001), thus null hypothesis is accepted and males with onset of DM 6-10 years and 26 – 30 years and females 21 – 25 years are more prone to DR.

COMPARISON OF ONSET OF DM WITH REFERENCE TO DN

TABLE - 14

ON SET OF DM	MALES	FEMALES	TOTAL	P-value
1 – 5	0	0	0	
6 – 10	4	0	4	
11 – 15	4	0	4	P= <0.00001%
16 – 20	1	2	3	
21 – 25	0	2	2	
26 – 30	0	0	0	
31 - 35	1	0	1	
	10	4	14	

From the above table it was concluded that out of 200 cases, when we Collate on set of DM with DN, Majority of cases was found in Males(10), where 4 in 6-10 years of onset of DM, 4 in 11-15 years, 1 in 16-20 years, 1 in 31-35 years. In females it was found that, 2 in 6-10 years of onset of DM, 2 in 21-25 years were reported. The least number found in both males & females is "zero" in 1-5 & 26-30 years of onset of DM. when we Collate two values in regression we get p-value (P=0.0001), and it is significant males with onset of DM 6-10 years and 11 – 15 years are more prone to DR compared to females.

COMPARISON OF ONSET OF DM WITH REFERENCE TO TIA

TABLE - 15

ON SET OF DM	MALES	FEMALES	TOTAL	P-value
1 – 5	0	1	1	P= <0.00001%
6 – 10	5	2	7	
11 – 15	5	0	5	
16 – 20	2	3	5	
21 – 25	1	1	2	
26 – 30	0	0	0	
31 - 35	1	0	1	
	14	7	21	

From the above table it was concluded that out of 200 cases, when we collate onset of DM with TIA, Majority of cases was found in Males (14), where 5 in 6-10 years of onset of DM,5 in 11 -15 years,2 in 16-20 years, 1 in 21 – 25 and 1 in 31 - 35. In females, majority of cases was found in 16-20 years of onset of DM i.e, 3, 1 in 1-5 years,2 in 6 – 10 years,1 in 21 – 25 years. The least number found in both males & females is "zero" in 26-30. when we Collate two values in regression we get p-value (P=0.0001), and is significant. Males with onset of DM 6-10 years & 11-15 years are more prone to TIA compared to females.

COMPARISON OF ONSET OF DM VS VASCULAR COMPLICATIONS

TABLE - 16

	1-5 years	6-10 years	11-15 years	16-20 years	21-25 years	26-30 years	31-35 years	Total	P-value
CAD	14	48	24	9	3	3	0	101	P= <0.00001%
ICS	4	19	7	6	0	0	0	36	
TIA	1	7	5	5	2	0	1	21	
DN	0	4	4	3	2	0	1	14	
DR	2	6	5	5	4	6	0	28	

In our current study, among 200 cases when we collate onset of DM w.r.t various vascular complications, we found that CAD Is evolving more i.e, 101, 36 ICS cases were evolved, 20 TIA, 14 DN, 28 DR. Out of which major period of developing vascular complication is found to be 6-10 years of onset of DM. Where, CAD had seen in 48 Subjects, ICS in 19, TIA in 7, DN in 4, and DR in 6. The least no.of cases are developed during 31-35 years of onset of DM i.e, 3 cases. When we collate the two values in regression we get a p-value (p=0.0001) which is significant.

DISCUSSION

- The data was collected prospectively from 200 diabetic patients and vascular complications were analyzed. Study included that the no. of male subjects developing Vascular complications (120) is greater than females (80).
- Most of Subjects who are diagnosed were b/w the age group 61-70 in both females (30) & males (40). The reason is aging, uncontrolled diet, sedentary style of leading life. This might be ascribed fact that 60 years above age group significantly diagnosed with Vascular complications.
- The majority of cases in men are admitted with HbAlC range 8.1 – 9.0 % (31) followed by HbA1C range 6.1-7.0 % (21), 7·1-8.0% (24), the least cases occurred at a range of 10.1-11.0 % (6).
- In females most of the cases are reported with HbA1C range 6.1 – 7.0 (19) & 7.1 – 8.0 (19) % followed by 9·1-10 0 % (15) & least cases are developed at HbA1C range of 10.1-11.0% (3).
- In our current study majority of males and females had developed vascular complications at total cholesterol levels of 191 to 220 mg/dl.
- Out of all the vascular complications CAD is most significantly developed i.e, (101) cases, followed by ICS 38 cases were evolved. The least was DN 14.
- In males, most of the cases are occurred at 6 – 10 (52) years of onset of DM followed by 11 – 15 years (29) and the least cases were reported at 31 – 35 years (2).
- In females most of the cases are reported at the onset of DM 6 – 10 years (31) followed by 11 – 15 years(17) and the least cases were recorded at 31 – 35 years (0).
- In males out of 120, majority of cases reported are ICS (21) least were SVD (5).
- In females, out of 80, majority of cases developed are ICS (15) least were Stable Angina (2).
- In CAD the majorly occurred complication in males is TVD -14 cases were reported, where as in females majorly occurred complication is NSTEMI-12 cases were reported.

CONCLUSION

- Overview of study reveals that CAD is a common complication found in the department of Cardiology.
- Chronic hyperglycemia is thought to contribute dysfunction of pancreatic beta cells and loss of insulin secretory capacity by exerting a glucose toxic effect and possibly exhaustion from the increased demand.

- Within CAD most frequently occurred complication is TVD in males & NSTEMI in females.
- Apart from cardiology,When we collate others ICS is highly seen in the department of Neurology in males.
- Most of the Vascular complications are noticed at 6-10 years of onset of DM in both the genders
- HbAlc range of 8.1-9.0%. included many of the admitted cases in men.
- HbAlc range of 6.1-8.0 included many of the admitted cases in Women
- Various Insulins are used for the management of DM by administering IV or SC
- Most of Patients who developed the complication had HTN as a comorbidity where it often triggers the current complication which is commonly prescribed with metoprolol.
- Aspirin is most commonly prescribed Medication among CAD Subjects.
- In our study, we found that social factors like consumption of alcohol and smoking had a greater risk of developing CAD compared to others.

Regular monitoring of glycemic status followed by a fair control in HbA1C range, dietary modifications, life style modifications decreases the risk of developing of vascular complications. We have to aware and educate the patient by conducting patient education programmes

SUMMARY

- DM is a long-term incurable common endocrine metabolic disorder distinguished by high blood glucose levels and interference in fat, carbohydrate, and protein metabolism.
- It is estimated that 5,37,000 thousand people suffering from DM based upon Study in 2019.
- About 200 thousand people lost their lives in 2020, directly due to DM. It is the 9th leading disease causing mortality/deaths globally.
- one in four adults is diabetic in China.
- Greater than 74 lakh Indians are presently affected with diabetes, greater than 8.3% in adult Public.

Diabetes-related vascular complications

- These problems are many and are induced, at minimum in part, by prolonged rises in blood sugar levels, which induce blood vessel damage.
- Diabetes produces persistent high blood sugar as well as a number of microvascular problems like diabetic neuropathy, diabetic nephropathy and diabetic retinopathy, as well as major macrovascular consequences such like coronary artery diseases (CAD), peripheral vascular diseases (PVD), and cerebrovascular diseases.
- CAD is responsible for approximately 1 out of 6 deaths in USA along with around 34% of subjects who experience a coronary attack. & of patients particularly undergone through myocardial infarction may undergo death within a year.

- The current study had been conducted in KIMS Sunshine Hospital. It is a prospective observational study. Data was gathered from Case sheets of patients who are willing to participate in the study after acquiring the consent.We registered 200 subjects for the study. Questions has been asked to the patient regarding the onset of diabetes, onset of vascular complications, food habits and comorbid conditions.
- In our current study majority of males and females had developed vascular complications at total cholesterol levels of 191 to 220 mg/dl.
- In our study, it was observed that more male subjects are admitted. Out of total 200 subjects 120 (60%) were males & 80(40%) were females followed by age group 61 – 70 years are more in both males (40) & females (30).In Males majority of them developing ICS (21) compared to other complications and the complications are occurring more likely in age group of 51 – 70 years (76). In females majority of them developing ICS (15) compared to other complications and the complications are occurring more likely in age group of 61 – 70 years (30).
- It was found that majority of subjects developing vascular complications at the HbA1C range 7.1 – 9.0 % in both the genders and majority of subjects developing ICS followed by 6 – 10 years of onset of DM in both the genders.
- In our current study, among 200 cases when we collate onset of DM w.r.t various vascular complications, we found that CAD Is evolving more i.e, 101, 36 ICS cases were evolved, 20 TIA, 14 DN, 28 DR. Out of which major period of developing vascular complication is found to be 6-10 years of onset of DM. Where, CAD had seen in 48 Subjects, ICS in 19, TIA in 7, DN in 4, and DR in 6. The least no.of cases are developed during 31-35 years of onset of DM i.e, 3 cases. When we collate the two values in regression we get a p-value (p=0.0001) which is significant.
- Regular monitoring of glycemic status followed by a fair control in HbA1C range, dietary modifications, life style modifications decreases the risk of developing of vascular complications. We have to aware and educate the patient by conducting patient education programmes.

LIMITATIONS

- Our study is limited by a small sample size due to less availability during the study period.
- A major drawback in our present study is a single place for the collection of data. To represent the national level, the authors recommend more studies in different places.
- A potential drawback of our study is less interaction with the subjects due to hospital norms.
- The access for collection of data from out-patients is denied.

FUTURE DIRECTIONS

- The statistic of population with DM will enormously elevate worldwide in subsequent years.
- Along with the DM vascular complications are more commonly occurring and the count increases further.
- Shortly, mostly individuals with DM are not achieving adequate glycemic control.
- Proper regulation glycemia control provided with following healthy lifestyle, dietary choices, regular exercise, bariatric surgery had greater chance of reducing vascular complication in diabetes.
- Developing new insulin therapy strategies and OAD's help in maintaining glycemic status
- Our study also emphasizing the need for creating more awareness among general practitioners and clinicians on this important public health issue of DM and associated vascular complications.
- The involvement of clinical pharmacists in clinical settings helps to increase the rational usage of medications and insulin thus, finally improving the patient's quality of life.
- Advances in comprehending the vascular pathology of DM make us to understand pathogenesis of DM vascular complications. A research study provides the better understanding of disease.
- Hyperlipdemia causes formation of plaques in the blood vessels of heart lead to obstruction of blood flow to heart. Advancement in the anti-hyperlipidemics helps for retardation of cardio vascular risk.

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