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Comorbidities and Complications Among Type 2 Diabetic Patients at a Tertiary Care Hospital in Ongole, Andhra Pradesh: A Prospective Observational Study

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Research Article

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Abstract

The study's objective is to determine how common type 2 diabetes mellitus problems and comorbidities are among patients at the government general hospital in Ongole, Andhra Pradesh. Goals: To calculate the frequency of co-morbidities and complications in individuals with type 2 diabetes. to evaluate the substantial correlation between complications and the length of diabetes. Methodology: Prospective observational studies were carried out on 800 patients in a tertiary care hospital's general medicine department who met the study's eligibility requirements. The information was gathered using carefully crafted proformas in accordance with the requirements, and it was then examined. Patients with diabetes who are between the ages of 18 and 80 are eligible. Patients with diabetes who are younger than 18 or older than 80 are not eligible. Individuals with gestational diabetes and type 1 diabetes mellitus are not included. Results: Of the 800 patients, 407 (50%) had HTN, 109 (13.6%) had CLD, 96 (12%) had pancreatitis, 83 (10.3%) had dyslipidemia, 77 (9.6%) had gastritis, and 48 (6%) had CKD. Patients with type 2 diabetes complications include 185 (23.1%) with CVD, 169 (21.1%) with CVA, 126 (15.7%) with neuropathy, 123 (15.3%) with retinopathy, 113 (14.1%) with nephropathy, 107 (13.3%) with diabetic foot ulcers, and 63 (7.8%) with ketoacidosis. 342 (42.7%) of the study's participants had diabetes for less than five years, whereas 190 (24%) have it for six to ten years, 120 (15%) for eleven to fifteen years, 80 (10%) for sixteen to twenty years, and 68 (9%) for more than twenty years. In conclusion: Patients with diabetes for less than five years were the primary focus of this research. Of them, 0.8% had nephropathy, 2.1% had CVD, 1.8% had CVA, 1.2% had diabetic foot ulcers, 0.6% had ketoacidosis, 0.3% had retinopathy, and 1% had neuropathy. 2.5% of patients have nephropathy, 3.3% have CVD, 3% have CVA, 2.2% have diabetic foot ulcers, 0.9% have ketoacidosis, 1.8% have retinopathy, and 1.3% have neuropathy after six to ten years of illness. 3.8%, 5%, 4.4%, 2.9%, 1.5%, 3.2%, and 3.5% of people with diabetes between the ages of 11 and 15 had nephropathy, CVD, CVA, diabetic foot ulcers, ketoacidosis, retinopathy, and neuropathy, respectively. The incidence of complications grows with the length of diabetes and eventually results in mortality.

Keywords: HTN, ketoacidosis, CVD, CVA, and type 2 diabetes.

Introduction

Hyperglycemia in the absence of therapy is a hallmark of a set of metabolic illnesses known as diabetes. Defects in insulin production, action, or both, as well as abnormalities in the metabolism of carbohydrates, proteins, and fats, are included in the heterogeneous aetiopathology. Retinopathy, nephropathy, and neuropathy are the main consequences of diabetes. Diabetes patients are also more likely to develop nonalcoholic fatty liver disease, obesity, cataracts, erectile dysfunction, and cardiovascular and cerebrovascular illnesses.

illness as well as some pancreatic issues. Additionally, they are more susceptible to some dangerous infectious infections, such TB.

HISTORY: Disorders marked by hyperglycemia are collectively referred to as diabetes. The Ebers papyrus, which was written about 1500 BC, was discovered in an old tomb in Thebes, Egypt, in 1862 AD. Egyptologist George Ebers published it in 1874. It depicts a malady known as "too great emptying of urine." According to Aretaeus of Cappadocia, who lived in the second century AD, "the fluid does not remain in the body but uses the man's body as a channel to leave it." He used the constant flow of urine, unending thirst, and the dissolution of limbs and flesh into urine to emphasize sickness. The first people to notice the sweetness of diabetic urine were the Hindu doctors Charak and Sushrut, who wrote between 400 and 500 BC. Additionally, they observed that those who indulged in sugary and fatty meals and were sluggish, overweight, and gluttonous had the highest prevalence of illness. Arabic medical books from the ninth to the eleventh centuries

AD also highlighted the significant fact that diabetic urine tastes pleasant [1]. Insulin was discovered in the 20th century in 1921 by Frederick Banting and Charles Best. They made a number of innovative attempts. For those with Type 1 diabetes, this medication is now life-saving. Later years saw the discovery of a treatment for Type 2 diabetes.

Epidemiology

Between 1980 and 2014, the number of diabetics rose from 108 million to 422 million. Diabetes is one of the top ten non-communicable illnesses that cause mortality worldwide, and its incidence among persons over the age of 18 rose from 4.7% in 1980 to 8.5% in 2014 [2]. Diabetes increases a person's chance of death by two to three times [3]. The number of people with diabetes worldwide rose from 11.3 million in 1990 to 22.9 million in 2017. In 2017, the age-standardized incidence rate rose from 233.6 to 284.6. Between 1990 and 2017, the number of people with diabetes worldwide rose from 211.2 million to 476.0 million. In 2017, the age-standardized prevalence rate rose from 4738.5 to 5886.9. Diabetes-related deaths worldwide rose from 0.61 million in 1990 to 1.37 million in 2017. The age-standardized mortality rate rose from

15.7 to 17.5 in 2017. Between 1990 and 2017, the number of disability-adjusted life years worldwide rose from 31.3 million to 67.9 million. In 2017, age-standardized DALY rates rose from 717.7 to 839.0. China (89.5 million), India (67.8 million), Indonesia (21.0 million), and Mexico (13.1 million) have the highest rates of diabetes prevalence, according to a 2017 poll. India (2,54,555), China (1,53,185), Indonesia (97,000), the United States (68,558), and Mexico (64,067) were the top five nations of death. India (11.2 million), China (10.0 million), Indonesia (4.4 million), the United States (3.9 million), and Mexico (2.6 million) were the five nations with DALYs. High BMI, dietary risk factors, and particulate matter pollution are the three main risk factors for diabetes out of 217 risk variables [4].

Etiology

AGE: The incidence of diabetes has increased in tandem with a sharp rise in life expectancy over the last 50 years. Diabetes mellitus, cardiovascular disease, cognitive decline, and other chronic illnesses may result from a reduction in physiological performance brought on by aging alone. Diabetes mellitus and aging are linked by intricate systems. Many individuals have asymptomatic hyperglycemia as they age, and growing metabolic dysregulation makes them more vulnerable to a number of age-related chronic illnesses, such as CVD and CVA. The biggest recognized risk factor for diabetes mellitus and cardiovascular disease is aging [5]. Physical inactivity is any movement of the body caused by skeletal muscle contraction that raises energy expenditure over a baseline level. According to the CDC [6], physical activity typically refers to the subset of physical exercise that improves health. There is not enough physical exercise to maintain good health and avoid early mortality.

Smoking

For both men and women, the prevalence of diabetes rises with smoking. males who smoke two packs a day at baseline have a 45% greater diabetes risk than males who have never smoked; women have a similar increase of 74%. After five years for women, quitting smoking lowers the incidence of diabetes to that of non-smokers; after ten years, smoking may raise a person's risk of type 2 diabetes [7].

Being overweight

The condition where the body accumulates extra fat is known as obesity. Obesity is the most overlooked public health issue in both industrialized and developing nations, according to the World Health Organization (WHO) (8). India has more than 72 million cases of diabetes mellitus in 2017 [9].

The World Health Organization projects that around 700 million individuals will be obese by 2025, and the number of overweight and obese people in the 41–60 age range is the main risk factor for diabetes [10]. One risk factor for type 2 diabetes that is mostly independent and changeable is obesity.

Alcohol

Heavy drinking reduces insulin sensitivity and increases insulin production, which may lead to hyperinsulinemia, particularly in the early stages of the illness [11]. Elevated levels of circulatory free fatty acid and decreased fat oxidative capability are caused by high ethanol concentrations [12]. Muscle insulin resistance is mostly caused by decreased fat oxidative capacity and metabolic rigidity [13], which may result

in decreased insulin binding [14] and suppression of insulin-related intracellular signaling [15].

Comorbidity

Comorbidities are typically defined as the co-existence of other conditions with an index condition (i.e., the primary condition being studied), where these other conditions are not consequences of the index condition. They can hasten the progression of individual conditions, promote the development of additional physical and mental conditions, and even result in early mortality [16].

High blood pressure

The force that flowing blood applies to the walls of the arteries, the body's main blood vessels, is known as blood pressure. Excessive blood pressure is known as hypertension [17]. Systolic blood pressure below 120 mmHg and diastolic blood pressure below 80 mmHg are considered normal. Systolic blood pressure between 120 and 139 mmHg and diastolic blood pressure between 90 and 99 mmHg are considered pre-hypertensive [18]. Peripheral vascular resistance and cardiac output are more crucial for maintaining normal blood pressure in women [20] than in males [19]. Gastritis

An acute or persistent inflammation of the stomach's mucosal layers is called gastritis. Food poisoning, viral infections, excessive alcohol consumption, and the use of irritating medicines may all contribute to it. Severe vomiting, appetite loss, thirst, and diarrhea are the symptoms [21]. NSAIDs, stress, bile reflux, radiation, alcoholism, cocaine addiction, and ischemia damage are some of the triggers that cause acute gastritis, also known as reactive gastritis. The damage to the stomach mucosa is caused by the triggering agent and reduced prostaglandin production. It uses systems to protect against the harmful effects of stomach acid [22]. Most individuals have a brief, asymptomatic first acute episode of gastritis.

Long-term liver damage

A liver condition that lasts longer than six months is referred to as chronic liver disease. It includes a variety of liver diseases, such as liver cirrhosis, liver inflammation, and liver cancer. Chronic liver disease often manifests as bruised ascites, peripheral edema, and jaundice. Chronic alcohol use, viral infections (hepatitis B, hepatitis C), and the use of some hepatotoxic medications (methotrexate, amiodarone, nitrofurantoin, paracetamol) are the causes of chronic liver disease [23]. An estimated 1.5 billion people worldwide suffer from chronic liver disease, and in their most severe state, CLDs often result in the development of cirrhosis, which is described as the permanent deformation of the liver architecture by fibrosis, scar, and aberrant nodules [24]. The age-standardized incidence of cirrhosis is 13 per 100,000 and that of chronic liver disease is 20 per 100,000.

Depression

Depression is a mental condition characterized by emotions of melancholy, grief, and rage that interfere with **daily life.**

According to the Centers for Disease Control and Prevention, 8.1% of American adults aged 20 and older suffer from depression (25). A population-based study conducted in India revealed that the prevalence of depression was 15.1%. India is home to an estimated 57 million people (18% of the world's population) who suffer from depression.

CKD

Gradual loss of kidney function is the definition of chronic kidney disease, commonly known as chronic renal failure. The kidneys' primary job is to filter waste products and extra fluid from blood, which is subsequently eliminated via urine. The body accumulates hazardous amounts of electrolytes, waste products, and fluids when chronic kidney disease (CKD) reaches an advanced stage [26]. Diabetes and hypertension are the usual causes of this non-communicable illness [27].

Issues

Patients with type 2 diabetes are more likely to have complications, which significantly increase morbidity and death. Microvascular and macrovascular complications are the two types of diabetic complications, with the former being more common than the latter [28].

Neuropathy, nephropathy, and retinopathy are examples of microvascular problems; stroke, cardiovascular disease, and peripheral artery disease are examples of macrovascular complications. Diabetes problems may

be avoided or postponed with proper blood pressure, blood sugar, and blood lipid management [29].

Diabetic Nephropathy and Microvascular Complications

About 20% to 40% of those with diabetes have diabetic nephropathy [30]. In a cross-sectional research from Egypt, 42% of the diabetic population had diabetic nephropathy [32]. Craig et al. observed that almost 50% of Indians had diabetic nephropathy after 20 years after the initiation of diabetes mellitus, and 15% of them had achieved end-stage kidney disease (31). Nephropathy affected 33% of Jordan's diabetic patients at national diabetes centers [33]. Additionally, 25% of diabetics in a Libyan clinic developed diabetic nephropathy [34]. According to recent research, the prevalence rates of diabetes-related end-stage renal disease for those 60–69 and older were 410.3 and

475.5 for white people and 1439.9 and 1471.5 for Africans, respectively [35]. By 2007, there were an estimated 40.94 million diabetics in India; by 2015, that number is predicted to rise to 60.9 million (36). It is clear from a research done in south urban India that 2.2% of diabetics, or more than 850,000 people, had nephropathy (37). In a 2020 research, 26 out of 200 participants had diabetic nephropathy, which was more common when risk factors such obesity and hypertension were present [38].

FOOT ULCERS WITH DIABETES

One of the most dangerous side effects of diabetes is diabetic foot ulcers. Significant morbidity, death, and a worse quality of life are linked to it [39]. Globally, diabetic foot ulcers are becoming more common [40]. A full-thickness lesion below the ankle in a diabetic patient, regardless of its duration, is referred to as a diabetic foot ulcer, according to the worldwide agreement on diabetic foot [41].

NEUROPATHY IN DIABETES

Asymmetrical, sensorimotor, and polyneuropathy, diabetic peripheral neuropathy is a microvascular complication of diabetes that increases morbidity and disability due to ulcerations and amputations (42). It is caused by metabolic and microvascular changes resulting from long-term hyperglycemia and metabolic disorders (43). First, diabetic peripheral neuropathy causes segmental demyelination, which in turn causes delayed nerve conduction velocity (44).

RETINOPATHY: The most frequent microvascular consequence of diabetes mellitus, retinopathy is the primary cause of vision loss in adults. Diabetic retinopathy is a frequent and serious visual condition that may result from uncontrolled diabetes [45]. Diabetes is becoming more common, although diabetic retinopathy is likely becoming less common due to improved control of blood sugar, lipid abnormalities, and hypertension [46]. Non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy are the two clinical phases of diabetic retinopathy.

[PDR, or diabetic retinopathy]. PDR is a more advanced stage of DR, whereas NPDR is the early stage [47].

MACROVASCULAR DIFFICULTIES

Heart disease:

The primary cause of morbidity and death linked to type 2 diabetes mellitus is T2DM, a secondary cardiovascular risk [48]. Congestive heart illness is three to five times more common in people with diabetes than in those without the condition [49]. Patients with diabetes have a significant lifetime risk of cardiovascular disease (67% in males and 57% in women at age 50) [50]. An increase of 1 mmol/1L of fasting plasma glucose causes an increase in cardiovascular events. According to these data, the risk of CVD starts in prediabetes, rises in those with diabetes, and is much higher in women with diabetes [51]. From 30 million in 1985 to 382 million in 2014, the worldwide burden of diabetes mellitus has grown over the last three decades, and graph rates have also climbed with time. The International Diabetes Federation Project projects that by 2035, 592 million people (1 in 10) will have diabetes.

Ketoacidosis in Diabetes

Uncontrolled hyperglycemia, metabolic acidosis, and elevated body ketone content are the hallmarks of diabetic ketoacidosis [52]. Hyperglycemia, dehydration, and acidity exacerbate diabetic ketoacidosis (DKA), a condition of relative or total insulin insufficiency. It happens when an absolute or relative lack of insulin prevents glucose from entering cells to be used as metabolic fuel, which causes it to quickly break down into ketones that may be used as fuel [53].

One of the main acute metabolic complications of type 1 diabetes is diabetic ketoacidosis [54], which is more common in women than in males. Patients who use injectable injections have a greater incidence than those who use subcutaneous insulin infusion pumps.

Methodology

Study location:

This research was carried out in the general medicine department of a tertiary care teaching hospital in Ongole, Prakasam district, Andhra Pradesh, India.

Study approval: The QIS College of Pharmacy's institutional ethics committee gave its permission to this study.

Study design: In general medicine, a prospective observational study was conducted. This research was conducted between November 2020 and April 2021, a duration of six months.

research population: For this research, 800 individuals were surveyed. Patients with diabetes who are between the ages of 18 and 80 are eligible.

Patients with diabetes who are younger than 18 or older than 80 are not eligible. Individuals with gestational diabetes and type 1 diabetes mellitus are not included.

Procedure for Studying800 individuals in a tertiary care hospital's general medicine department who met the study's criteria were included in prospective observational studies. SPSS software version 25 was used to analyze the data, which was gathered using well-designed Proforma in accordance with the criteria.

Findings AGE

One of the main risk factors for diabetes mellitus is age. Of the 800 patients, 262 (32.7%) are between the ages of 50 and 59, 180 (23.6%) are between the ages of 40 and 49, 177 (22.1%) are between the ages of 60 and 69, 109 (13.6%) are between the ages of 70 and 79, and 63 (7.8%) are between the ages of 30 and 39.

BMI Of the 800 patients, 398 (49.75%) are overweight, 204 (25.5%) are obese, 190 (23.75%) are normal, and 8 (1%) are underweight.

Gender: 308 (38.5%) are women and 492 (61.5%) are men.

OBESITY: 204 patients (25.5%) are obese, whereas 596 patients (74.5%) are not.

Alcoholic Of the 800 patients, 267 (34%) are not alcoholics and 532 (66%) are.

SMOKING: Of the 800 replies, 239 patients (30.37%) do not smoke, whereas 557 patients (69.62%) do.

Duration of Diabetes Related To Their Complications

Table: 1

VARIABLES	Nephropathy	CVD	CVA	Diabetic foot ulcer	Ketoacidosis	Retinopathy	Neuropathy
<5 years	1.2%	4.7%	5%	2.3%	1.5%	0%	3.2%
6 – 10 years	8%	14.2%	13.5%	8.4%	4.2%	9.5%	7.8%
11–15 years	20.8%	35%	30%	20%	10%	21%	23%
16-20 years	41.3%	60 %	55%	35%	25%	45%	6.2%
>20 years	58.8%	76.%5	69.1%	45.5%	29.4%	66.2%	58.8%

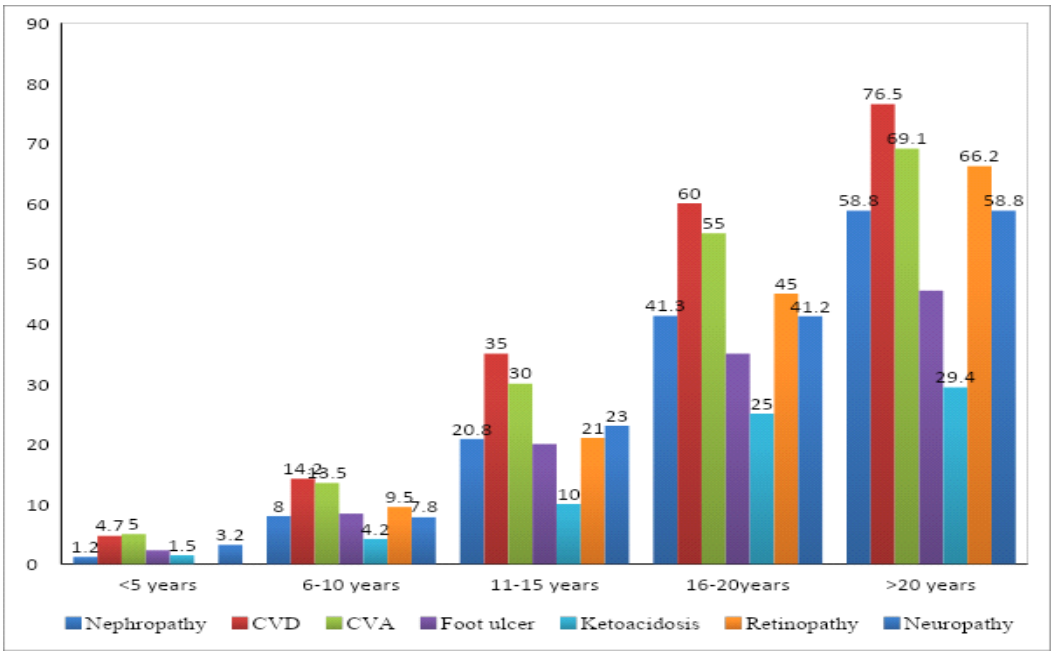


Table: 2 Various types of Complications associated with Type 2 Diabetes.

Variable	Frequency	Percentages
Complications		
CVD	185	23.10%
CVA	169	21.10%
Neuropathy	126	15.70%
Retinopathy	123	15.30%
Nephropathy	113	14.10%
Diabetic foot ulcer	107	13.30%
Ketoacidosis	63	7.80%

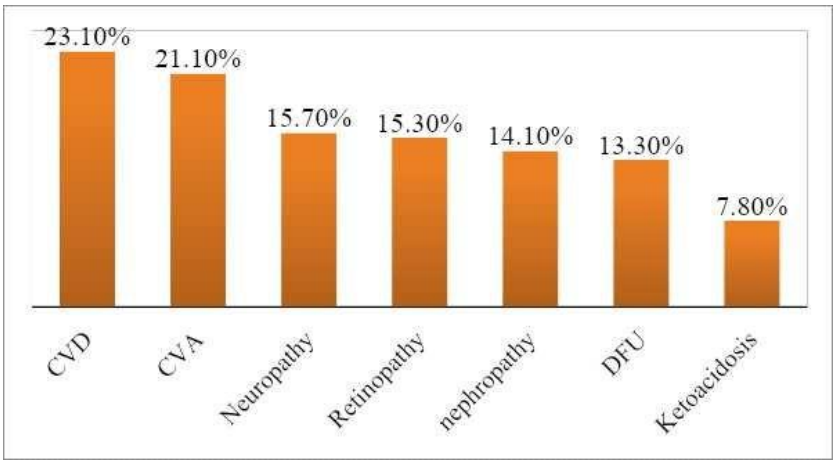
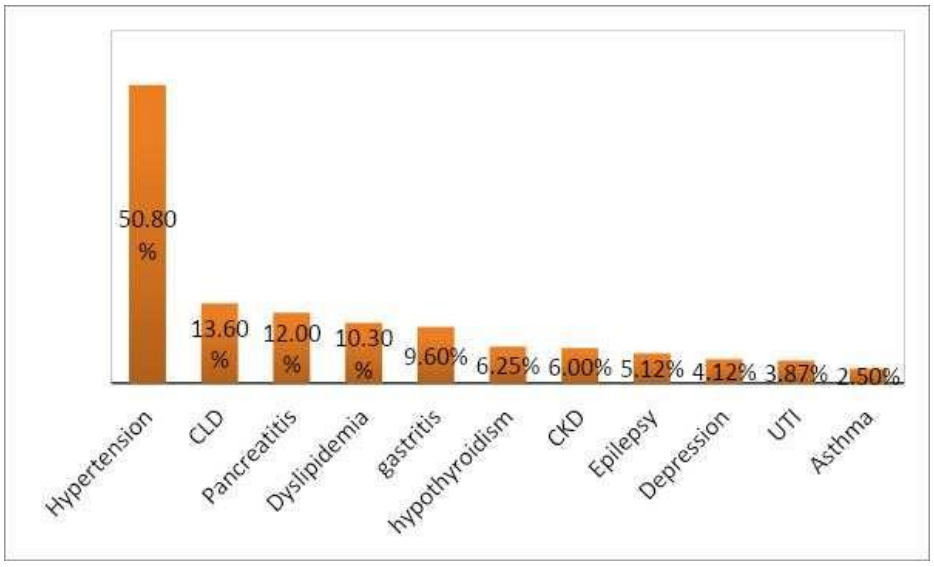


Table :3 Comorbidites associated with Type 2 Diabetes

Variables	**frequency**	percentages
Co morbidities		
Hypertension	407	50.80%
CLD	109	13.60%

Pancreatitis	96	12.0%
Dyslipidemia	83	10.30%
Gastritis	77	9.60%
Hypothyroidism	50	6.25%
CKD	48	6.0%
Epilepsy	41	5.12%
Depression	33	4.12%
UTI	31	3.87%
Asthma	20	2.50%



Conclusion

Patients with diabetes for less than five years were the primary focus of this research. Of them, 0.8% had nephropathy, 2.1% had CVD, 1.8% had CVA, 1.2% had diabetic foot ulcers, 0.6% had ketoacidosis, 0.3% had retinopathy, and 1% had neuropathy. 2.5% of patients have nephropathy, 3.3% have CVD, 3% have CVA, 2.2% have diabetic foot ulcers, 0.9% have ketoacidosis, 1.8% have retinopathy, and 1.3% have neuropathy after six to ten years of illness. 3.8%, 5%, 4.4%, 2.9%, 1.5%, 3.2%, and 3.5% of people with diabetes between the ages of 11 and 15 had nephropathy, CVD, CVA, diabetic foot ulcers, ketoacidosis, retinopathy, and neuropathy, respectively. The incidence of complications grows with the length of diabetes and eventually results in mortality.

Reference

1. Papaspyros NS. Diabetes history. In: verlagGT, ed. Diabetes mellitus's past.

2. Emerging Risk Factors Collaboration, Stuttgart: Thieme, 1964:4.g. A cooperative meta-analysis of 102 prospective studies on diabetes mellitus, fasting blood glucose levels, and vascular disease risk. 2010; 375(9733):2215-22; The Lancet.

3. Global, regional, and national comparative risk assessment of 84 behavioral, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Stanaway JD, Afshin A, Gakidou E, Lim SS, Abate D, Abate KH, Abbafati C, Abbasi N, Abbastabar H, Abd-Allah F, and Abdela J. The Lancet, 392(10159):1923-94, 2018.

4.Lin X, Xu Y, Pan X, Xu J, Ding Y, Sun X, Song X, Ren Y, and Shan PF. Diabetes burden and trend in 195

nations and territories: a global, regional, and national study from 1990 to 2025. reports from scientists. September 8, 2020, 10(1):1–13.campisi

J. Cellular senescence, cancer, and aging. Physiology Annual Review, 2013, 75:685-705.

5. Green Synthesis of Silver Nanoparticles utilizing Litsea glutinosa L. Leaves and Stem Extracts and their Antibacterial Efficacy, Koteswara Rao P, Vikram Babu B, Rama Krishna A, Sushma Reddi M, Sathish Mohan B, Anjani Devi K, Susmitha U, and Raghava Rao T. Water and Environmental Nanotechnology Journal. December 1, 2022, 7(4):363-9.

6. Savji N, Rockman CB, Skolnick AH, Guo Y, Adelman MA, Riles T, Berger JS. Vascular disease with old age in various arterial REFERENCES QIS COLLEGE OF PHARMACY | DEPARTMENT OF PHARMACY PRACTICE Page 68 territories: a population database of more than 3.6 million people. American College of Cardiology Journal. 2013; 61(16):1736-43.

7. US Department of Health and Human Services (USDHHS).50 Years of Progress on the Health Effects of Smoking.A representative of the surgeon general.U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, Atlanta, GA, 2014.

8. World Health Organization. Preventing and controlling the worldwide obesity pandemic.

9. Srinivasan P, Uppugalla S. Polyaniline and sulfur-doped activated carbon electrodes in an aqueous electrolyte make up a high-performance supercapacitor coin cell. Solid State Electrochemistry Journal. January 2019, 23(1), 295-306.

10. Atlas ID. International Diabetes Foundation, 2017.

11. Methyl triphenylphosphonium permanganate as a new oxidant for aniline to polyaniline-manganese (II, IV) oxide: material for high performance pseudocapacitor, Uppugalla S, Boddula R, Srinivasan P. Solid State Electrochemistry Journal. February 2018, 22(2):407-15.

12. ShekarGC, ShekarVC, Kumar VS, and Sreelatha M.Thyroid Profile Study in Patients with Type 2 Diabetes Mellitus. 2017; 5:211–20.

13. Wauters M, Considine RV, Yudkin JS, Peiffer F, De Leeuw I, Van Gaal LF. Leptin levels in type 2 diabetes: correlations with indicators of insulin secretion and resistance. 35(02):92-6. Hormone and Metabolic Research, 2003.

14. Heidendal GA, Saris WH, Kemerink GJ, Langenberg CJ, Wolffenbuttel BH, Wagenmakers AJ, Blaak EE, and Glatz JF. Type 2 diabetic muscle has lower levels of fatty acid-binding protein and plasma FFA consumption. The American Journal of Physiology: Endocrinology and Metabolism. 2000; 279(1):E146-54.

15. Phielix E, Mensink M. Skeletal muscle metabolism and type 2 diabetes mellitus. behavior and physiology. 2008; 94(2):252-8.

16. Singh SP, Kumar Y, Gilden JL, Ellyin FE, Snyder AK. Alcohol's impact on normal and noninsulin-dependent diabetic subjects' glucose tolerance. Clinical and experimental research on alcoholism. 12(6):727-30, 1988.

17. Different effects of ethanol on insulin-signaling via the insulin receptor substrate-1. de la Monte SM, Ganju N, Tanaka S, Banerjee K, Karl PJ, Brown NV, Wands JR. AlcoholClinExpRes. 23:770–777, 1999.

18.Uppugalla S, Male U, Srinivasan P. Design and production of a carbon/polyaniline hybrid material doped with heteroatoms for high-performance electrode use in supercapacitors. Acta Electrochimica. November 10, 2014, 146:242-8.

19. Li X, Chattopadhyay K, Xu S, Chen Y, Xu M, Li L, Li J. A cross-sectional investigation of the prevalence of comorbidities and variables related to them in patients with type 2 diabetes at a tertiary care department in Ningbo, China. BMJ open. 11(1):e040532, 2021.

20. World Health Organization, International Society of Hypertension Writing Group. 2003 World Health Organization/International Society of Hypertension (ISH) Hypertension Management Statement. Hypertension Journal. 2003; 21(11): 1983-92.