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Epidemiological Studies of Microvascular and Macrovasacular Complications in Diabetes Mellitus Type 2

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ABSTRACT

Aim: To perform an observational study on epidemiology of micro and macrovascular complications in diabetes mellitus type II.

Objectives: To assess the occurrence and prevalence of micro and macrovascular complications in type 2 diabetes mellitus.

Methodology: The study's methodology will be carried out in the internal medicine department of Gleneagles Aware Hospital in Bairamalguda, Saroornagar, Hyderabad, Telangana state. Over 6 month period with 100 patients individuals with microvascular problems. Patients aged 20 to 80 years, included with comorbid conditions in both genders. Patient demographics, medication records, laboratory tests, medical histories, and other relevant data were gathered using a well-designed data-collecting form for any in patients with diabetes mellitus who were experiencing problems.

Results: The study findings revealed that most of the complications that occur in diabetic mellitus are macrovascular complications. Out of 100 subjects, 65 were males and 35 were female, 70 had macrovascular complications. In 70, (2) peripheral artery disease, (29) coronary artery disease, (39) ischemic stroke. And 30 are microvascular complications, (1) diabetic retinopathy, (4) diabetic neuropathy, (25) diabetic nephropathy. The age group between 61-70 (36) was found to have the most macrovascular and microvascular complications.

Conclusion: The study concluded among 100 patients, who are affected by micro vascular and macrovascular complications in type 2 diabetes mellitus, are studied during the study period.

Keywords: *Diabetic retinopathy, Diabetic neuropathy, Diabetic nephropathy, Peripheral artery disease, coronary artery disease, Ischemic stroke*

1. INTRODUCTION

Diabetes mellitus (DM)

The Elevated blood glucose levels are a characteristic of the group of metabolic disorders. Defects in insulin secretion and impairments in insulin sensitivity are caused by a number of underlying factors, which lead to elevated blood glucose and long-term complications. Type 1 diabetes is caused by inadequate insulin production, and patients with diabetes are divided into two categories. [1]

Epidemiology:

Twenty-four million Americans have type 2 diabetes, and an additional 57 million may have prediabetes. Of these, about one-fourth do not have a diagnosis. In people with type 2 diabetes, cardiovascular events account for two-thirds of fatalities. [2]

Since identical twins exhibit almost exact similarities in the development of the disease, a significant amount of type 2 diabetes results from genetic inheritance. About 85% of children whose parents have type 1 diabetes are obese, and their risk of getting the disease is still between 1% and 2%.[3]

Complications:

Both type 1 and type 2 diabetes mellitus have similar problems, which can be divided into vascular and nonvascular categories. Microvascular (retinopathy, neuropathy, nephropathy) and macrovascular complications (CHD, peripheral arterial disease [PAD], cerebrovascular disease) complications of diabetes mellitus (DM).[4]

Microvascular complications:

Damage or malfunction of the tiny blood arteries (microvasculature) in different organs and tissues is one of the microvascular problems associated with Type 2 Diabetes Mellitus (T2DM).

Affected organs and tissues include:

1. Eyes (retinopathy, macular edema)

2. Kidneys (nephropathy, microalbuminuria)

3. Nerves (neuropathy, autonomic neuropathy)

4. Feet (ulcers, impaired wound healing)

5. Brain (cognitive impairment) [5]

1.Diabetic Retinopathy:

Individuals with diabetes may develop diabetic retinopathy, a disorder that gradually damages the retina, the light-sensitive layer at the back of the eye. Diabetic retinopathy is a serious and potentially blinding side effect of diabetes. The swelling of the retinal tissue brought on by blood and other fluids leaking from these tiny blood vessels is known as diabetic retinopathy.

There are two types of diabetic retinopathy:

1. Diabetic retinopathy with proliferation

2. Diabetic retinopathy that does not proliferate. [6]

Clinical Features:

In its early stages, diabetic retinopathy may show no symptoms. But as the illness worsens, you might notice: Dark lines or patches that appear in your field of vision (floaters), visual impairment, Changing vision, dark or empty areas in the field of vision, vision loss, blurriness or distortion of vision, night blindness, new color blindness, or colors that appear faded, having trouble seeing or reading clearly. [7]

2.Diabetic Neuropathy:

Damage to the peripheral nerves causes diabetic neuropathy, a complication of diabetes that impairs sensory, motor, and autonomic nerve functions.

Diabetic neuropathy types include:

1. Pain and distal sensory loss are symptoms of distal symmetric polyneuropathy (DSPN).

2. Autonomic Neuropathy (AN): Impacts the nerves that control automatic processes like digestion and heart rate.

3. Mono Neuropathy (MN): Mono neuropathy (MN) is the dysfunction of isolated cranial or peripheral nerves. [8]

Diabetic Nephropathy:

The progressive kidney disease known as diabetic nephropathy is typified by harm to the tubulointerstitium, glomeruli, and renal microvasculature.

Nephropathy's clinical characteristics include:

Diabetic nephropathy may not show any symptoms in its early stages. But as the illness worsens, the following symptoms could appear:

A challenge in managing elevated blood pressure. swelling around the eyes, hands, ankles, or feet, urine that is foamy, confusion or problems with cognition, breathing difficulties, appetite loss, vomiting and nausea, Itching.[9]

Macrovascular Complications:

The dysfunction of large blood vessels in Type 2 Diabetes Mellitus (T2DM) is characterized by the following macrovascular issues:

Plaque buildup in arteries is known as atherosclerosis.

Inflammation of the arteries

Endothelial dysfunction

Reduced blood flow [5]

Peripheral Artery Disease:

Over thirty percent of diabetics over fifty years of age have PVD. The arteries in the legs are especially affected by PVD, which can result in intermittent claudication, a cramping pain that occurs when walking and is caused by reversible muscle ischemia brought on by atherosclerosis.[10]

Clinical Features:

This is the most common manifestation of lower limb PAD. It is typified by ischemic pain that affects the leg muscles. Since the superficial femoral artery is most frequently affected by the disease, the pain is typically felt in the calf; however, if the iliac arteries are also affected, it may be felt in the thigh or buttock.[11]

Coronary Artery Disease:

An inadequate supply of blood and oxygen to a portion of the myocardium is the hallmark of coronary artery disease, also known as ischemic heart disease. This frequently happens when the heart's oxygen supply and demand are out of balance. Atherosclerosis affecting one or more epicardial coronary arteries is the main cause of myocardial ischemia. This condition results in decreased blood flow and insufficient perfusion of the myocardium supplied by the artery. [12]

Insufficient oxygen-rich blood flow to the heart causes coronary artery disease symptoms. Typical symptoms include :

Chest Pain (Angina),

Shortness of Breath,

Fatigue [13]

Ischemic Stroke:

An ischemic stroke happens when the brain's blood supply is diminished or stopped, usually as a result of blood artery narrowing or blockage. Brain tissue is deprived of vital oxygen and nutrients as a result of this disruption.[14]

Clinical Features:

Speaking difficulties, lightheadedness, problems with balance, severe headache, abrupt disorientation, Double vision and weakness or numbness on one side of the body are examples of visual issues.[15]

2. METHODOLOGY:

The research study will be carried out in the Department of Internal Medicine, at Gleneagles Aware Hospital, Bairamalguda, Saroornagar, Hyderabad, Telangana state.

Study duration: The proposed duration for this study is six months.

Sample design: Observational study.

Sample size: This study includes 100 patients.

Ethical statement: Only with the hospital ethics committee's approval can the study be carried out.

Tools: Ward rounds, Lab investigation reports, Patient medication, Patient case reports.

Statistical tool: Categorical variables analysed using SPSS and Chi-square method.

Study criteria:

• Inclusion criteria:

o Age between 20 –80 Both Genders (Male and female)

o Comorbid Condition

o In-patient's department

• Exclusion criteria:

o Surgery

o HIV

o OPD

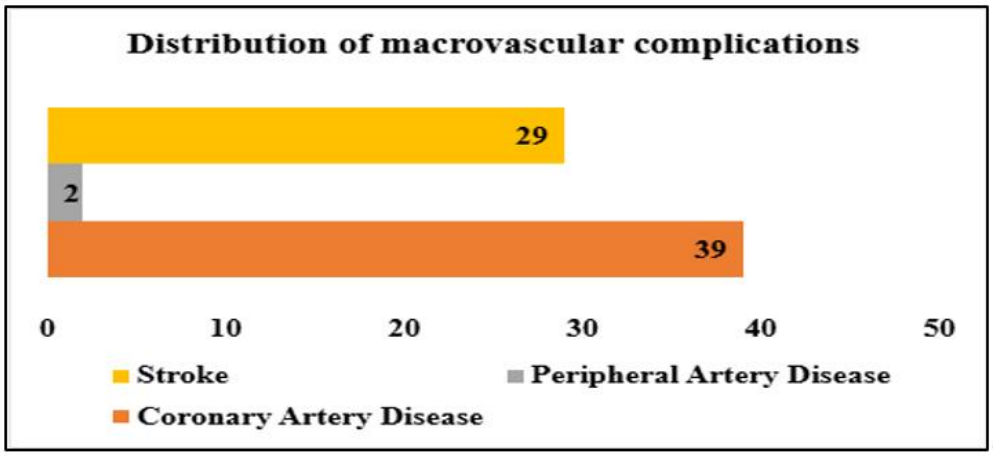
o Pregnancy Data collection: Patient laboratory records will be the source of all pertinent and essential data.

3. RESULTS

Table 1: Distribution of subjects based on macrovascular complication:

S. No	Macrovascular Complication	Number of Subjects	P Value
1	Coronary Artery Disease	39	<0.05
2	Peripheral Artery Disease	2	
3	Stroke	29	

Figure 1: Bar graph representation of distribution of subjects based on macrovascular complications distribution.

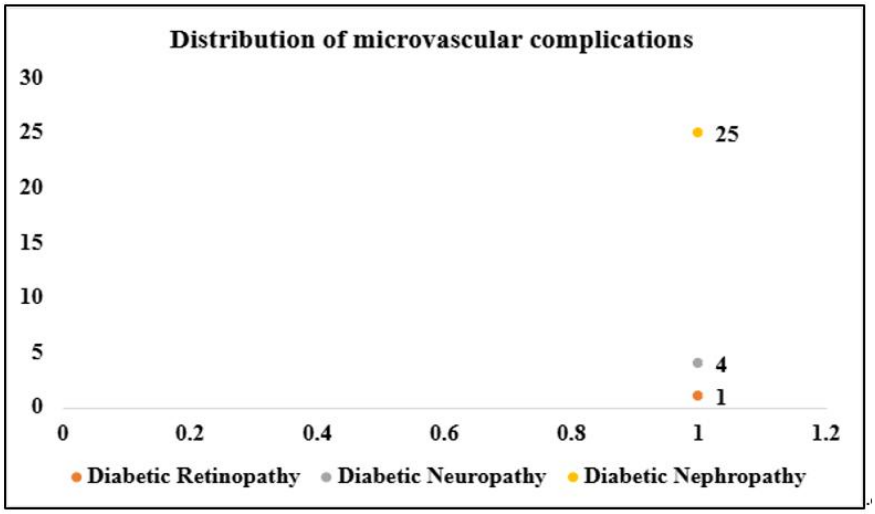


In the study population, 39 patients suffered from CAD, and 2 patients suffered from PAD, 29 patients suffered from stroke.

Table 2: Distribution of subjects based on microvascular complication:

S. No	Microvascular Complication	Number of Subjects	P Value
1	Diabetic Retinopathy	1	<0.05
2	Diabetic Neuropathy	4	
3	Diabetic Nephropathy	25	

Figure 2: Scatter graph representation of distribution of subjects based on microvascular complications distribution.



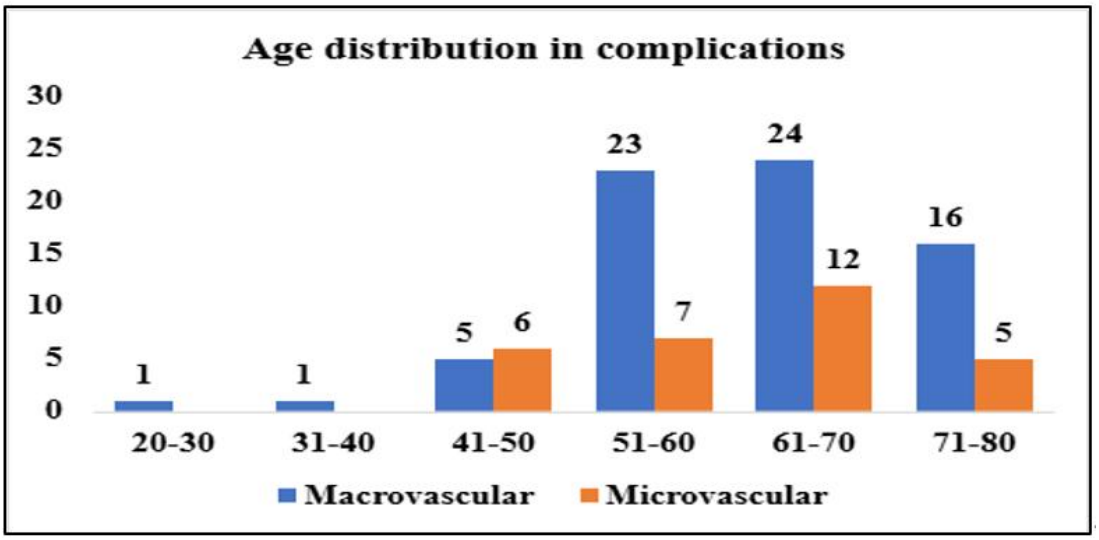
In the study population, 1 patient suffered from diabetic retinopathy, 4 patients suffered from Diabetic neuropathy, 24

patients suffered from diabetic nephropathy.

Table 3: Distribution of age groups in macrovascular & microvascular complication

S. No	Age	Macrovascular	Microvascular
1.	20-30	1	0
2.	31-40	1	0
3.	41-50	5	6
4.	51-60	23	7
5.	61-70	24	12
6.	71-80	16	5

Figure 3: clustered bar graph representation age groups of subjects based on macrovascular and microvascular complications.



In the study population, the age group of 61-70 (24) in macrovascular and 12 in microvascular were found to be the most.

4. DISCUSSION

In the previous research that was done in 130 subjects (28 patients) had suffered from diabetic neuropathy.[16] In the current study, out of 100 subjects (4 patients) had suffered from diabetic neuropathy.

In the preceding study, that prevalence of DM associated stroke or CVD decreased, in contrast prevalence of DM with PVD shows increased.[17] In the current study prevalence of DM associated with stroke or CVD increased. In contrast, prevalence of DM with PVD decreased.

In the earlier study carried out 55.35% had hypertension comorbidity in microvascular complications diagnosed within 12 months.[18] In current study carried, 52% had hypertension comorbidity in microvascular complications diagnosed within 6 months.

In earlier study carried out 626 patients of diabetic nephropathy, out of 626, 294 male patients and 332 female patients, in age group between 29 to 100 years.[19] In the current study, out of 100 patients, 25 had diabetic nephropathy. Out of 25, 17 are male and 8 are female in age group between 20-80 years.

In the preceding study carried out, in 174 subjects 107 males, 67 females. 68 patients had CKD,

144 patients had retinopathy, 150 patients had PAD, 81 patients had CAD.[20] In current study, in 100 subjects, 65 males, 35 females, 15 patients had CKD, 1 patient had retinopathy, 2 patients had PAD, and 39 patients had CAD.

In the earlier study carried out, in 4067 patients in which 1176 had retinopathy, 1323 patients had nephropathy, 1225patients had neuropathy, 780 had CAD, 735 patients had PAD.[21] In the current study 1 patient had retinopathy, 25 patients had nephropathy, 4 patients had neuropathy, 39 patients had CAD, and 2 patients had PAD.

In the earlier study carried 72% of subjects experienced at least one complication. Out of 100% among them 19% had

microvascular complications and 10% had macrovascular complications. In 19% of microvascular complications 28% had neuropathy, 20% had nephropathy, 6.5% had retinopathy. In 19% of microvascular complications 18% had PAD, 5% had stroke, 3% had CAD.[22] In current study carried, 100% of subjects experienced at least one complication among then 30% had microvascular and 70% had macrovascular. In 30% of microvascular, 1% had retinopathy, 4% had neuropathy, 25% had nephropathy. In 70% of macrovascular, 2% had PAD, 29% had stroke, 39% had CAD.

In the earlier study carried out, it was found that 4.3% of the individuals belonging to the age group of 40 years and older with peripheral artery disease.[23] Whereas in the current study conducted, it was observed that the age group between 60-70 years 20% had peripheral artery disease.

In the earlier study carried out, it was found that individuals having 32.3% of neuropathy in 8757 patients.[24] In the current study 4% of the study population had diabetic neuropathy in 100 patients.

5. CONCLUSION

In the study, the age-group between 20-30(1),31-40 (1), 41-50 (11), 51-60 (30), 61-70 (36),71-80 (21). So, the age group between 61-70 (36) was found to have both macrovascular and microvascular complications the most.

In the study population out of 100 subjects 65 patients were found to be male and 35 were found to be female. 70 patients were found to have macrovascular complications, while 30 patients had microvascular complications. Hence macrovascular complications were found to be most.

In the study population, 39 patients had coronary artery disease (CAD), 2 patients had peripheral artery disease (PAD), and 29 patients experienced a stroke. Hence CAD found to be more.

In the study population, 1 patient had diabetic retinopathy, 4 patients had diabetic neuropathy, and 24 patients had diabetic nephropathy. Hence diabetic nephropathy is found to be more.

In the study population, 95 patients had diabetes mellitus,52 patients had hypertension,7 patients had urinary tract infection,7 patients had anemia,7 patients had thyroid, and 20 patients had lv dysfunction. Hence diabetic mellitus was found to be more.

In the study population, the age group of macrovascular between 20-30 (1), 32-40 (1), 41-50 (5), 51-60 (23), 61-70 (24), 71-80 (16). The age group of microvascular between 41-50 (6), 51-60 (7), 61-70 (12), 71-80 (5). So, the age group of 61-70 years had the highest number of cases, with 24 patients experiencing macrovascular complications and 12 patients experiencing microvascular complications.

In the study population, 45 males and 25 females had macrovascular complications, while 20 males and 10 females had microvascular complications. So, the macrovascular complications in both male and female found to be more.In the study of macrovascular, 2 patients had obesity, 52 patients had hypertension, 95 patients had diabetes, and 1 patient had hyperlipidemia. So, the diabetes mellitus was found to be more. In the microvascular, 25 patients had nephropathy,2 patients with obesity, 1patient had dyslipidemia and 52 patients had hypertension. So, the hypertension found to be more.In the study population, 20 patients had ischemic stroke, while 9 patients had hemorrhagic stroke. So, the ischemic stroke found to be more.

CONFLICT OF INTEREST: Nil

REFERENCES

[1] Joseph T. Dipiro , Gary C. Yee, L.Michael posey stuart T. Haines, Thomas D.Nolin, Vicki Ellingsod. chapter no 91 diabetic mellitus, Editors: Joseph T. Dipiro, gary c.yee, L.michael posey, Stuart T.Haines, Thomas D. Nolin, Vicki L. Ellingrod , Pharmacotherapy a pathophysiologic Approach 11thedition p.3570.

[2] Joseph T. Dipiro , Gary C. Yee, L.Michael posey stuart T. Haines, Thomas D.Nolin, Vicki Ellingsod. chapter no 91 diabetic mellitus, Editors: Joseph T. Dipiro, gary c.yee, L.michael posey, Stuart T.Haines, Thomas D. Nolin, Vicki L. Ellingrod , Pharmacotherapy a pathophysiologic Approach 11th edition p.3574.

[3] Joseph T. Dipiro , Robert L.Talbert , Gary C. Yee, Gary R. Matzke, Barbara G. Wells, Michael Posey, chapter no:83 Diabetic Mellitus, editors: Joseph T. Dipiro , Robert L.Talbert , Gary C. Yee, Gary R. Matzke, Barbara G. Wells, Michael Posey, Pharmacotherapy A pathophysiological Approach 8th edition p.1256.

[4] Loscalzo, Fauci, Kasper, Hauser, Longo, jameson chapter no 405, Diabetes Mellitus: Complications, Editors: Joseph Loscalzo, Dennis L. Kasper, Dan L. Longo, Anthony S. Fauci, Stephen L. Hauser, J. Larry Jameson, Harrison's Principles of Internal medicine 21st edition p.3120.

[5] Loscalzo, Fauci, Kasper, Hauser, Longo, jameson chapter no 405, Diabetes Mellitus: Complications, Editors: Joseph Loscalzo, Dennis L. Kasper, Dan L. Longo, Anthony S. Fauci, Stephen L. Hauser, J. Larry Jameson, Harrison's Principles of Internal medicine 21st edition p.3121.

[6] Loscalzo, Fauci, Kasper, Hauser, Longo, jameson chapter no 405, Diabetes Mellitus: Complications, Editors:

Joseph Loscalzo, Dennis L. Kasper, Dan L. Longo, Anthony S. Fauci, Stephen L. Hauser, J. Larry Jameson, Harrison's Principles of Internal medicine 21st edition p.3122.

[7] Schreur V, van Asten F, Ng H, Weeda J, Groenewoud JMM, Tack CJ, Hoyng CB, de Jong EK, Klaver CCW, Jeroen Klevering B. Risk factors for development and progression of diabetic retinopathy in Dutch patients with type 1 diabetes mellitus. Acta Ophthalmol. 2018 Aug;96(5):459-464.

[8] Loscalzo, Fauci, Kasper, Hauser, Longo, jameson chapter no 405, Diabetes Mellitus: Complications, Editors: Joseph Loscalzo, Dennis L. Kasper, Dan L. Longo, Anthony S. Fauci, Stephen L. Hauser, J. Larry Jameson, Harrison's Principles of Internal medicine 21st edition p.3124.

[9] Medically reviewed by Deborah Weatherspoon, Ph.D., MSN-Written by Tom Seymour Updated on January 19, 2022.

[10] Cate Whittlesea, Karen Hodson. Chapter 45, diabetic mellitus. Editor: Cate Whittlesea, Karen Hodson, Clinical Pharmacy and Therapeutics,6thEdition (2019). P. 772.

[11] Stuart H.Ralston, Ian D. Penman, mark W.J. Strachan, Richard P.Hobson, Chapter no:16, Diabetes mellitus, Editors: Stuart H.Ralston, Ian D. Penman, mark W.J. Strachan, Richard P.Hobson, Davidson's principles and practice of medicine 24thEdition p. 484.

[12] Cate Whittlesea, Karen Hodson. Chapter 20, coronary artery disease. Editor: Cate Whittlesea, Karen Hodson, Clinical Pharmacy and Therapeutics,6thEdition (2019). P. 335.

[13] Cate Whittlesea, Karen Hodson. Chapter 20, coronary artery disease. Editor: Cate Whittlesea, Karen Hodson, Clinical Pharmacy and Therapeutics,6thEdition (2019). P. 338.

[14] Joseph T. Dipiro , Gary C. Yee, L.Michael posey stuart T. Haines, Thomas D.Nolin, Vicki Ellingsod. chapter no 27 Stroke, Editors: Joseph T. Dipiro, gary c.yee, L.michael posey, Stuart T.Haines, Thomas D. Nolin, Vicki L. Ellingrod , Pharmacotherapy a pathophysiologic Approach 11thedition p.353

[15] Joseph T. Dipiro , Gary C. Yee, L.Michael posey stuart T. Haines, Thomas D.Nolin, Vicki Ellingsod. chapter no 27 Stroke, Editors: Joseph T. Dipiro, gary c.yee, L.michael posey, Stuart T.Haines, Thomas D. Nolin, Vicki L. Ellingrod , Pharmacotherapy a pathophysiologic Approach 11thedition (2011). p.354

[16] Sandhya Gautham, Chhaya Mittal, Alok Ranjan, Gajraj Singh, Association of Diabetic Peripheral Neuropathy with Micronutrients, Journal of Association of Physician of India (2024) may, volume 72 issue 5 p. 65-67.

[17] Chien-Hsing Lee a,b, Yi-Ling Wu c, Jeng-Fu Kuo d, Jung-Fu Chen e, Ming-Chu Chin c, YiJen Hung b,f, Prevalence of diabetic macrovascular complications and related factors from 2005 to 2014 in Taiwan: A nationwide survey, Journal of the Formosan Medical Association (2019 august 29) 118, S96-S102.

[18] Cameron Hurst, Bandit Thinkhamrop, Hoang The Tran, The Association between Hypertension Comorbidity and Microvascular Complications in Type 2 Diabetes Patients: A Nationwide CrossSectional Study in Thailand, Epidemiology Diabetes & Metabolism Journal 2015; 39(5): 395-404.

[19] Alwakeel, Jamal S; Al-Suwaida, Abdulkareem; Isnani, Arthur C.; Al-Harbi, Ali; Alam, Awatif, Concomitant Macro and Microvascular Complications in Diabetic Nephropathy, Saudi Journal of Kidney Diseases and Transplantation May–Jun 2009, 20(3): p 402-409.

[20] Chandy, Anila; Pawar, Basant; John, Mary; Isaac, Rajesh, Association between diabetic nephropathy and other diabetic microvascular and macrovascular complications, Saudi Journal of Kidney Diseases and Transplantation Nov–Dec 2008.19(6): p 924-928.

[21] RP Agrawal, M Ranka, R Beniwal, S Sharma, VP Purohit, DK Kochar, RP Kothari, Prevalence of Micro and Macro Vascular Complications in Type 2 Diabetes and Their Risk factors, S.P. Medical College, Bikaner, Int. J. Diab. Dev. Countries (2004), Vol. 24, p 11-26.

[22] R. Williams, L. Van Gaal & C. Lucioni, Assessing the impact of complications on the costs of Type II diabetes, Springer-Verlag 2002 12 June, Volume 45, pages S13–S17.

[23] Elizabeth Selvin, MPH; Thomas P. Erlinger, MD Prevalence of and Risk Factors for Peripheral Arterial Disease in the United States,2004 American Heart Association, Inc Circulation. 2004; 110:738-743.

[24] Domenico Fedele, MD; Giancarlo Comi, MD; Carlo Coscelli, MD; Domenico Cucinotta, MD; Eva L Feldman, MD; Giovanni Ghirlanda, MD; Douglas A Greene, MD; Paolo Negrin, MD; Fausto Santeusanio, MD;, A Multicenter Study on the Prevalence of Diabetic Neuropathy in Italy , Diabetes Care may 01 1997;20(5):836–843.

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