ORIGINAL ARTICLE

# To Determine Frequency and Outcome of Dyslipidemia in Diabetic Foot Patients

FARHEEN KHADIM[1], KASHIF ALI SAMIN[2], AMNA BALOCH[3], SHAZIA YOUSAF[4], JAHANGIR ANJUM[5], SABA SHAFIQ[6]
[1]Post Graduate Resident, General Medicine, Divisional Headquarter Teaching Hospital, Mirpur AJK
[2]Assistant Professor Family Medicine, Khyber Medical University, Peshawar
[3]House Officer Gynae & Obs, PMCH, Nawabshah
[4]Assistant Professor, Mohtrama Benazir Bhutto Medical College, Divisional Head Quarter Teaching Hospital Mirpur AJK
[5]Assistant Professor Medicine, Mohtarma Benazir Bhutto Shaheed Medical College / Divisional Headquarters Teaching Hospital, Mirpur Azad Kashmir
[6]Post Graduate Trainer, Islamic International Medical College, Rawalpindi
Corresponding author: Naumana Rehman, Email: naumanarehman@gmail.com

## ABSTRACT

**Objective:** To determine frequency and outcome of Dyslipidemia in Diabetic foot patient
**Study Design:** Cross sectional study
**Place and Duration:** Divisional Head Quarter Teaching (DHQ) Hospital Mirpur AJK from January 2021 to January 2022.
**Methodology:** This study includes one hundred and thirty nine (139) patients with Type 2 diabetes and diabetic foot related complication. Patient diagnosed case of type2 DM on oral hypoglycemic agents or on insulin therapy of age >30 of either gender admitted with history of wound in lower limb confirmed on physical examination measuring ankle brachial pressure Index(ABPI) were evaluated for ulcer ,cellulitis and gangrene by using WAGNER's classification. Dyslipidemia is assessed in these patient by sending their fasting lipid profile and data is entered into specially designed Performa.
**Results:** We found that majority of cases having abnormal lipid profile. Dyslipidemia with significant difference was found in diabetic foot patients, 54.7% (n=76) patients show HDL <35 ,56.1%(n=77 )have cholesterol >200mg/dl and 69.8%(n=97) have TAG>150mg/dl. 29.5% patient with diabetes have superficial ulcer, while deep ulcer, cellulitis, localized and extensive gangrene was found with percentage of 31.7% , 20.1% ,10.8%, 7.9% respectively .
**Conclusion**: We concluded that Dyslipidemia is a modifiable risk factor for diabetic foot related complications. So diabetic patients must be advised regular Lipid Profile to decrease risk of diabetic foot related complication.
**Keywords:** Diabetes Mellitus (DM), Dyslipidemia, Diabetic foot, PAD and neuropathy

## INTRODUCTION

Diabetes is a metabolic disorder that is due to defect in secretion of insulin from pancreas or resistance to its action or both .International diabetes federation of diabetes Atlas predicts that there are 463 million Diabetic patients worldwide and number of patients will begin to rise to 578 million in 2030 to 640 million by 2040[1]. The prevalence of Type2 Diabetes is increasing since last 3 decades because of increase in sedentary life style, obesity and unhealthy food consumption. Diabetes is responsible for macro and micro-vascular complications which include neuropathy, nephropathy, retinopathy and peripheral arterial disease 2,3. Of these complication, diabetic neuropathy and peripheral arterial disease are related to diabetic foot related complication[4].

Diabetic foot is defined as "reduced blood supply due micro vascular disease often in association with lack of sensation (neuropathy), predisposes diabetic people at risk of diabetic foot ulcer, abscess /osteomyelitis, destruction of foot tissue(gangrene) and amputation"[5]

Diabetic neuropathy is defined as" sign and symptoms related to nerve dysfunction in patients with diabetes in the absence of other causes of neuropathy such as B12, toxins, HIV, autoimmune and drug related neuropathy"[6].

Peripheral arterial diseases (PAD )in legs or lower extremities is defined as narrowing or blockage of vessels of lower limb that carry blood from heart to lower limbs. PAD is caused by the process of atherosclerosis in which fatty plaques are formed within the vessels and result in ischemia of leg /foot.

American Heart Association defined Dyslipidemia as" Triglyceride (TAG )>150mg/dl, High Density lipoprotein(HDL) <40mg/dl in male and <50mg/dl in female with cholesterol >200mg/dl"[7,8]. ADA (American diabetes association)define Diabetes Mellitus (DM) as Fasting blood sugar level 126mg/dl or higher, Random blood sugar level 200mg/dl or higher, blood glucose after 2-hour Oral glucose tolerance test (OGTT) 200mg/dl or higher and HbA1c >6.5%8. Dyslipidemia damages endothelial lining of blood vessels that result in atherosclerosis and diabetic foot related complications. Dyslipidemia in diabetics can either due to quantitative or qualitative defect in lipoprotein. In diabetic patients increased level of TAG and cholesterol along with decreased HDL cholesterol is commonly observed abnormality[9].

Both elevated TAG and cholesterol and reduced HDL predisposes to atherogenic phenomenon which result in foot Ulcers ,infection and tissue destructions and even gangrene and finally amputation. Atherosclerosis is responsible for death in diabetic patients due to coronary heart disease, cerebrovascular or peripheral vascular disease.[10] Thus, it is recommended for every Diabetic patients to check their Fasting lipid profile at time when they are Diagnosed and then after every six monthly and then every yearly or as clinically indicated, to reduce risk of diabetic foot related complication.

## MATERIAL AND METHODOLOGY

A cross sectional study conducted from January 2021 to January2022 at General Medicine department at DHQ Hospital Mirpur. The study is designed to find out the frequency and outcomes of Dyslipidemia in diabetic foot patient. A sample size of 139 was calculated 95% confidence level ±5% with margin of error of population proportion value p=0.90 using formula Z21-@/s1_P/E2P with the help of WHO calculator. Of, these 139 patients of either, gender male and female age>30 either on oral hypoglycemic or on insulin with an evidence of diabetic foot related complication using Wagner classification for lower limb infection secondary to neuropathy and PAD included in this trial. PAD is assessed by palpating peripheral pulses (Dorsalis pedis and posterior tibial) and measuring ABPI using Doppler Ultrasound. Neuropathy is determined by asking neuropathy symptoms such as paresthesia, numbness, tingling and aching ((Diabetic neuropathy symptom score) and checking vibration(128 HZ tuning fork), proprioception ,temperature, pinprick sensation and Achilles tendon reflex using (Diabetic neuropathy disability Score). Patients Age<30, type 1 diabetes, having established macro-vascular complications like ischemic heart disease (IHD) & stroke, decompensated heart failure, chronic kidney disease, chronic liver disease, pregnant and lactating women are excluded. Patient were assessed for Dyslipidemia leading to diabetic foot related complication at 1st visit ,at 6 month then after 1 year. Diabetic foot related complication secondary to Dyslipidemia were assessed by using WEGNAR CLASSIFICATION for lower limb infection .The Data collected on predesigned Proforma. All evaluated in statistical program version (SPSS)20. One hundred

and thirty nine diagnosed patients of diabetes mellitus aged more than 30 years of both genders with random blood sugar levels >200 mg/dl or fasting blood sugar >126 mg/dl included via consecutive non probability sampling. Ankle brachial pressure index is measured by asking patient to lay supine for at least 10 minutes before measurement. Appropriate sized blood pressure cuff for both arm and ankle the cuff width should be greater than 20% greater than diameter of extremity. Ankle cuff should be placed between malleolus and the calf and brachial cuff above cubital fossa .Systolic Blood pressure from both sites is taken. Divide ankle systolic to brachial systolic blood pressure.

Dyslipidemia is defined on the basis of laboratory report of fasting lipid profile showing serum cholesterol >200 mg/dl, serum triglyceride>150 mg/dl and HDL <40mg/dl males and <50mg/dl in females[8,9]. After obtaining approval from Institution Ethic Review Board (IERB), patients were selected according to inclusion and exclusion criteria. Written informed consent was taken from study population after introducing them to study and its objectives. All patients were investigated for the presence of Dyslipidemia by getting a fasting lipid profile from DHQ laboratory. Patient Name, age, laboratory reports (fasting lipid profile) were entered in the specially designed Proforma. All data collected was entered in SPSS version 20. Frequencies and percentages were calculated for variables like Age, gender and Dyslipidemia like Hypercholesterolemia, Hypertriglyceridemia and HDL .Frequencies of Diabetic foot complication secondary to Dyslipidemia also determined in our study.

## RESULT

Total 139 patient were included in study.Male 63.4% (N=102) were found in majority as compared to female26.6 %( N=37).Majority of cases were found with abnormal lipid profile shown in TABLE-l.Mean and SD of HDL <35 was 37.5 ±11.4mg/dl .Mean and SD of serum cholesterol >200mg/ was 224.63 ±65.67mg/dl and TAG>150mg/dl is 195.38 ±73.44mg/dl.Outcome was assessed according to Wagner's Classification given in TABLE -IV. Male patients are more affected with diabetes and Dyslipidemia.

Table-1: Showing Frequency of Dyslipidemia

| Lipid profile | Frequencies | Percentage |
|---|---|---|
| Dyslipidemia | 83 | 59.95% |
| Normal lipid profile | 56 | 40.05% |
| Total | 139 | 100% |

Table-2: Frequency of Various Lipid Abnormalities in Diabetics

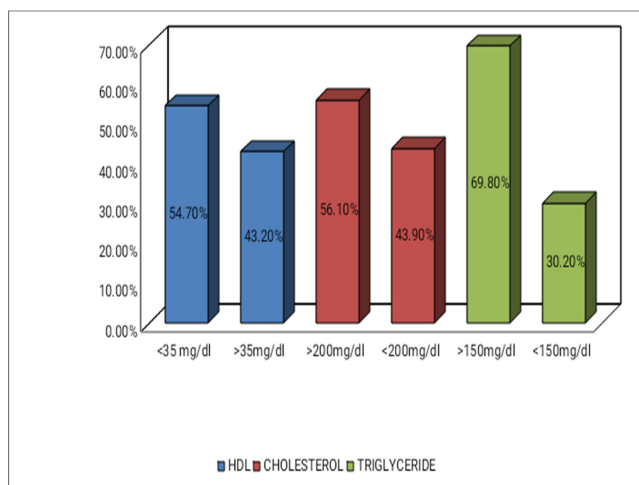| Lipid profile | Frequency | Precentage |
|---|---|---|
| Hdl < 35 mg/dl | 76 | 54.7% |
| Cholesterol > 200mg/dl | 77 | 56.1% |
| Triglyceride>150 mg/dl | 97 | 69.8% |



Figure 3: Showing Frequency of HDL, Cholesterol and Triglyceride

Table 3: Diabetic Foot Outcome According to Wagner's Grade

| Wagner's grade | Frequency | Percentage |
|---|---|---|
| Superficial ulcer(grade 1) | 41 | 29.5 % |
| Deep ulcer(grade2) | 44 | 31.7% |
| Abcess/bon e involement(grade3) | 28 | 20.1% |
| Localized gngrene(grade 4) | 15 | 10.8% |
| Extensive gangerene(grade5) | 11 | 7.9% |
| Total | 139 | 100% |

Table 4: Showing Demographic characteristics and Results of Study population

| | | |
|---|---|---|
| Age | Mean 48 SD±10 Min 31 Max78 | |
| Gender | Male n =83(59.95%) Female n=56(40.05%) Total=139 | |
| Weight | 66(49- 84kg) | |
| Duration of diabetes | 12(7-18)YEARS | |
| BodyMass Index(kg/m2)% | 28.5(26-30) | |
| Peripheral PULSES | Reduced in 31(22.3%) Absent in n =22(15.8%) | |
| Ankle brachial pressure index for peripheral arterial disease | | |
| 0 - 0 .4 | Severe PAD sufficient to cause gangrene | n=22(28.4%) |
| 0 .4- 0 .9 | PAD sufficient to cause Claudication | n =44(31.6%) |
| 0.9 -1.3 | Normal vessel | n=65(46.7%) |
| >1.3 | Non compressible severely calcified vessel | n =(5.7% |
| Neuropathy | | n=60(43.1%) |

## DISCUSSION

Dyslipidemia in relation to diabetes has been discussed over many and dyslipidemia is associated with poor outcomes in Diabetic. Dyslipidemia is commonly observed metabolic abnormality in patient with Diabetes Mellitus[11,]. Dyslipidemia shows variable prevalence, and various factors such as duration and type of diabetes, age, dietary factors and Blood sugar control determine it[12]. Characteristics abnormalities of lipids that are found in Type2 Diabetes Mellitus include elevated Triglyceride (TAG) levels, decreased in High Density lipoprotein (HDL) levels and increased levels of Serum total cholesterol[13]. Diabetic foot is the most common problem observed in diabetics either due to PAD or neuropathy. Diabetic patients are at high risk of foot infection, ulcer and gangrene, because of a decreased blood supply secondary to atherosclerosis[14]. Dyslipidemia accelerates process of atherosclerosis that result in damage of endothelial lining of blood vessels and decreases blood flow through them. In addition, pressure and local trauma (often in association due to lack of sensation as a result of neuropathy), and peripheral arterial disease (PAD), result in multiple foot infections such as simple foot Ulcer, abscess/cellulitis osteomyelitis and gangrene of feet. Diabetic foot infection in patients with micro-vascular disease are difficult to treat as in such cases wound healing is poor ,as these people have micro vascular disease, so phagocytes have poor access to the infected area and result in a poor concentration of antibiotics at the site of infected wound. Peripheral arterial disease that involves major vessels, micro-vasculature and capillaries results in gangrene and amputation. Another study carried out in 2010 at Jamshoro shows increased risk of diabetic foot related complication in patients with Dyslipidemia[12]. We have found that Male are more frequently affected with diabetes than female and have Dyslipidemia which place them at risk for developing diabetic foot related complication.

Overall, Diabetic patients show increased incidence of atherosclerosis, capillary basement membrane thickening, arteriolar thickening, and increased endothelial proliferation. Thickening and calcification of the arteriolar wall is frequently noticed in diabetic patient. Diabetic patient develop atherosclerotic diseases which effect large and medium sized arteries, such as

aortic, iliac, femoral and popliteal vessels[14,15]. However, significant atherosclerotic disease of infra popliteal vessels such as Dorsalis pedis and posterior Tibial is particularly found in diabetic population affecting lower limb digits or whole foot[16]. The reason for increased incidence of atherosclerotic diseases in diabetic patients is thought to result from high low-density lipoprotein (LDL) and elevated TAG and cholesterol level[17,18]. A study conducted in ethopia in 2019 shows high prevalence of Dyslipidemia in diabetic patient[19].Hyindicates insulin resistance particularly low high density lipoprotein (HDL) and high Triglyceride and serum cholesterol2[0].

So, every Diabetic patient must be advised for checking fasting lipid profile every 6 to 12 monthly or as clinically indicated. Patients should be asked for checking Lipid profile if patients are taking lipid lowering thereby. They should repeat tests after one and half month interval then every 3 monthly. Assessing diabetic patients for PAD by examining peripheral pulses and measuring ABPI (Ankle brachial pressure index) and neuropathy (symptoms, sensation and deep tendon reflexes) prevent diabetic foot related problems.

## CONCLUSION

Dyslipidemia is a modifiable risk factor for Diabetes. So Lipid profile should be measured frequently during regular follow ups .It will help to decrease risk of atherosclerosis leading to PAD hence diabetic foot related complication .In addition to lipid profile, diabetic foot related complication can also be prevented by assessing patient for neuropathy and vasculopathy by checking lower limb sensation, reflexes, pulses and ABPI(Ankle Brachial pressures Index).

**Conflict of Interest:** This study has no conflict of interest to be declared by any author.

## REFERENCES

1    .AlHewishel MA, Bahgat M, Al Huwaiyshil A, Alsubie MA, Alhassan A. 25 (OH) D serum level in non-diabetic and type II diabetic patients: a Cross-Sectional Study. Cureus. 2020 Jun 29;12(6).
2    Mooradian AD. Dyslipidemia in type 2 diabetes mellitus. Nature Reviews Endocrinology. 2009 Mar;5(3):150-9.
3    Goldberg IJ: Diabetic dyslipidemia: causes and consequences. J Clin Endo Metab 2001, 8(3):965–971.
4    Naveed S, Nageen A, Ahmed SM, Ali Z, Fatima M, Khan ZA. Diabetes Lipidus-A persistent problem. Frequency and patterns of dyslipidemia among the diabetic adults of Pakistan. The Professional Medical Journal. 2021 Mar 10;28(03):293-9.
5    Yazdanpanah L, Shahbazian H, Nazari I, Hesam S, Ahmadi F, Cheraghian B, Arti HR, Mohammadianinejad SE. Risk factors associated with diabetic foot ulcer-free survival in patients with diabetes. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2018 Nov 1;12(6):1039-43.
6    Pop-Busui R, Boulton AJ, Feldman EL, Bril V, Freeman R, Malik RA, Sosenko JM, Ziegler D. Diabetic neuropathy: a position statement by the American Diabetes Association. Diabetes care. 2017 Jan 1;40(1):136-54.
7    Dixit AK, Dey R, Suresh A, Chaudhuri S, Panda AK, Mitra A, Hazra J. The prevalence of dyslipidemia in patients with diabetes mellitus of ayurveda Hospital. Journal of Diabetes & Metabolic Disorders. 2014 Dec;13(1):1-6.
8    Alqahtani N, Khan WA, Alhumaidi MH, Ahmed YA. Use of glycated hemoglobin in the diagnosis of diabetes mellitus and pre-diabetes and role of fasting plasma glucose, oral glucose tolerance test. 9. International journal of preventive medicine. 2013 Sep;4(9):1025.Americann Diabetes Association. Dyslipidemia management in adults with diabetes. Diabetes care. 2004 Jan 1;27(suppl_1):s68-71
10   Sultana MS, Akhter Y, Parvin M, Alam MM, Naznin L, Wahab MA. Lipid profile pattern in type 2 diabetes mellitus patients. Journal of Armed Forces Medical College, Bangladesh. 2018;14(2):177-9.
11   American Diabetes Association. Standards of medical care in diabetes--2012. Diabetes Care. 2012 Jan. 35 Suppl 1:S11-63.
12   Memon H, Rahimoon AG, Yousafani A. Frequency and outcome of dyslipidaemia in diabetic foot patients with type-II diabetes mellitus. Indo Am J Pharm Sci. 2017 Oct 1;4(10):3470-5.
13   Sugden M, Holness M. Pathophysiology of diabetic dyslipidemia: implications for atherogenesis and treatment. Clin Lipidol. 2011;6(4):401–411. doi:10.2217/clp.11.32
14   Chahil TJ, Ginsberg HN. Diabetic dyslipidemia. Endocrinology and Metabolism Clinics. 2006 Sep 1;35(3):491-510.
15   Filippatos T, Tsimihodimos V, Pappa E, Elisaf M. Pathophysiology of Diabetic Dyslipidaemia. Current vascular pharmacology. 2017 Jan 1;15(6):566-75.
16   Kalofoutis C, Piperi C, Kalofoutis A, Harris F, Phoenix D, Singh J. Type II diabetes mellitus and cardiovascular risk factors: current therapeutic approaches. Experimental & Clinical Cardiology. 2007;12(1):17.
17   Yazdanpanah L, Shahbazian H, Nazari I, Hesam S, Ahmadi F, Cheraghian B, Arti HR, Mohammadianinejad SE. Risk factors associated with diabetic foot ulcer-free survival in patients with diabetes. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2018 Nov 1;12(6):1039-43.
18   Pokharel DR, Khadka D, Sigdel M, Yadav NK,  S, Kafle R, Sapkota RM, Sigdel T. Prevalence and pattern of dyslipidemia in Nepalese individuals with type 2 diabetes. BMC research notes. 2017 Dec;10(1):1-1.
19   Haile K, Timerga A. Dyslipidemia and its associated risk factors among adult type-2 diabetic patients at Jimma University Medical Center, Jimma, Southwest Ethiopia. Diabetes, metabolic syndrome and obesity: targets and therapy. 2020;13:4589.
20   Al Ghadeer HA, Al Barqi M, Almaqhawi A, Alsultan AS, Alghafli JA, AlOmaish MA, AlGhanem ZA, Alsaqar AH, Alatiyyah AT, Alburayh YA, AlOmair A. Prevalence of Dyslipidemia in Patients With Type 2 Diabetes Mellitus: A Cross-Sectional Study. Cureus. 2021 Dec 6;13(12).