ORIGINAL ARTICLE

Correlation of diabetic foot and renal function in patients with diabetes mellitus

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Abstract

Background: Diabetes mellitus (DM) is consistently an increasing public health concern with multiple complications, almost converting into an epidemic. Diabetic foot ulcers are the most disabling problem in diabetic patients with a yearly incidence of around 2–4% in developed countries. At present, diabetes is the most common cause of kidney problems, not only in developing countries but also in developed countries as well. The risk of peripheral arterial disease leading to foot ulcers increases as the GFR value decreases. In more advanced stages of renal failure, when the GFR reaches less than 15-20 cc/min, renal clearance of insulin decreases.

Objective: The objective of this study is to evaluate and analyze the relationship between diabetic foot ulcers and renal function in diabetic patients.

Materials and Methods: An observational study was conducted from August 2017 to December 2017 at Hamdard University Hospital. A total of 84 patients participated with history of diabetes and diabetic foot ulcers. Data analysis was performed in SPSS software.

Results: There were 84 individuals identified with diabetic foot ulcers in between August 2017 and December 2017. Among 84 individuals, 45(53.6%) were male and 39(46.4%) were females. The results showed that the incidence of diabetic foot ulcers was higher in men than in women. The HbA1C statistics showed that 12(14.3%) individuals had a value of <7.0%, 59(70.2%) were in between 7.1%- 9.0% and 13(15.5%) had a value >9.0%, it indicates that most of them had a poor glycemic control. The renal function status was confirmed by 24hrs urinary creatinine clearance. 34.5% had a CrCl <30ml/min, 56.0% was in between 31-70ml/min and only 9.5% had CrCl> 70ml/min. Finally, we noticed that the renal function status was very poor in these individuals who had diabetes with poor glycemic control and with diabetic foot ulceration.

Conclusion: In this study, we observed a close relationship between the severity of renal failure in diabetic patients and diabetic foot ulcers. Most studies have pointed to a link between chronic kidney disease and peripheral arterial disease. Based on our study, we hypothesized that serum urea and creatinine are not sensitive indicators for assessing renal insufficiency, that's why urinary creatinine clearance should be done for further assessment of renal function.

Keywords: diabetes, diabetic foot, kidney function, 24 hrs creatinine clearance, GFR

Introduction:

Diabetes Mellitus (DM) is an emerging public health problem with multiple complications and an increasing prevalence.[1] In 2013, the International Diabetes Federation (IDF) estimated that 382 million people worldwide had diabetes, and by 2035 it is expected to increase to 592 million. 80 percent of people live in low and middle-income countries, more than 60% of whom live in Asia and China accounts for almost a third.[2] Foot ulcers are the most common problem, with an annual incidence of about 2-4% in developed

Table-1: Frequency distribution of the participant's HbA1C

		Frequency	Percentage	Effective Percentage	Cumulative Percentage
Valid	< 7.0%	12	14.3	14.3	14.3
	7.0% -9.0%	59	70.2	70.2	84.5
	>9.0%	13	15.5	15.5	100.0
	Total	84	100.0	100.0	

Table-2: Frequency distribution of participant's CrCl

		Frequency	Percentage	Effective Percentage	Cumulative Percentage
Valid	< 30 ml/min	29	34.5	34.5	34.5
	30- 70 ml/min	47	56.0	56.0	90.5
	> 70 ml/min	8	9.5	9.5	100.0
	Total	84	100.0	100.0	

countries,[3] and may even be higher in developing countries. The most important factors in the development of foot ulcers are peripheral sensory neuropathy, foot deformities associated with motor neuropathy, mild foot trauma, and peripheral arterial disease. Once the skin is ulcerated, it is easily infected, which is an urgent medical problem. Only two-thirds of foot ulcers eventually heal,[4,5] and up to 28% of foot ulcers may cause some form of lower limb amputation.[6] Today, diabetes is the most common cause of kidney problems in both developed and developing countries.[7] In the later stages of renal failure, when GFR is below 15-20 cc/min, the renal clearance of insulin is reduced. This has a more important clinical significance in the treatment of diabetes.[8] The purpose of this study was to assess and analyze renal function status in patients with diabetic foot.

Materials and Method:

This is an observational study conducted between August 2017 and December 2017. This study used a simple random technique with the goal of being an ordinary person hospitalized at Hamdard University Hospital. The study included a total of 84 patients with a history of diabetes and diabetic foot ulcers. Patient information such as age, gender, location, duration of diabetes, diabetes control methods, body mass index (BMI), wound severity, GFR and renal function status were collected from patient records. GFR was measured by 24-hour creatinine clearance. Participants were briefed on the purpose of the study and obtained verbal consent. Statistical analysis was done using SPSS software.

Results:

Between August 2017 and December 2017, 84 patients with diabetic foot ulcers were identified as being at least 40 years old. Who has at least three visits. The average age of the individual was 59.96 years old. Of the 84 patients, 45(53.6%) were male and 39(46.4%) were female. The results showed that the incidence of diabetic foot ulcers was higher in men than in women. The height of 44(52.4%) is between 5.1" - 5.5"(feet and inches), and 40 (47.6%) is between 5.5" - 6.0" m(feet and inches). 8.0% of the population weighs 45-55kg, 16.0% weighs 56-65kg, 52.0% weighs 66-75kg, 22.0% weighs 76-85kg, and only 2.0% weighs 86-95kg. BMI was calculated based on the individual's height and weight. The results showed that the BMI of the 2.0% population was <18.5, the BMI of 54.0% was between 18.6-24.9, and the BMI of 44.0% was >24.9. The individuals were also asked about duration of diabetes which showed that 7(8.3%) individuals had duration < 5 years, 75(89.3%) had a time period in between 5-15 years and only 2(2.4%) had a duration >15years. Among our study population, 31(36.9%) used to take oral hypoglycemic agent while 53(63.1%) used to take injectable, indicating that most of them were on injectable hypoglycemic treatment. The HbA1C statistics showed that 12(14.3%) individuals had a value of <7.0%, 59(70.2%) were in between 7.1%- 9.0% and 13(15.5%) had a value >9.0%, as shown in Table 1, it indicates that most of them had a poor glycemic control.

In order to find out renal status of individuals, further workup was also done, particularly serum urea, serum creatinine and glomerular filtration rate via 24hrs urinary creatinine clearance. The serum urea of 26.0% patients was in between 10-50mg/dl, 56.0% was in between 51-100mg/dl and 18.0% was in between 101-150mg/dl. The serum creatinine of 60.0% was in between 0.5- 1.5mg/dl while 40.0% had a value > 1.5mg/dl. The statistics of serum urea and creatinine, indicating that the urea level of

most patients was higher while creatinine level of most of them was in normal range. This renal function status was further confirmed by 24hrs urinary creatinine clearance. 34.5% had a CrCl <30ml/min, 56.0% was in between 31-70ml/min and only 9.5% had CrCl> 70ml/min, as shown in Table 2. Finally, we noticed that the renal function status was very poor in these individuals who had diabetes with poor glycemic control and with diabetic foot ulceration.

Discussion:

Foot problems in diabetes continue to challenge clinicians who care for these patients. Not only are they associated with morbidity and disability, but they also lead to a significant decline in quality of life.[9] Diabetes is a strong risk factor for chronic kidney disease (CKD). Surprisingly, the overall incidence of Diabetic Foot Ulcer (DFU) and Lower Extremity Amputation (LEA) is low in CKD and diabetic patients. Regarding CKD and LEA, most studies have focused on end-stage renal disease (ESRD) and are often noted in relation to peripheral arterial disease (PAD), thus claiming a common cause of atherosclerosis.[10]

Several studies have published up till now regarding renal function status in association with diabetic foot ulceration. The study design included only patients with diabetic foot ulcers and impaired renal function. We use simple clinical tests to assess and confirm renal function status. Apart of our study objective, we also gather information regarding age, sex, height, weight, BMI, duration of diabetes and type of hypoglycemic agent used by the individuals. Glycemic control was also assessed by HbA1C of each individual.

Renal function was assessed by glomerular filtration rate (GFR) levels. GFR is difficult to measure directly and is therefore usually estimated based on serum levels of endogenous markers. Serum creatinine is the most commonly used measure for assessing renal function; however, serum levels are affected by factors other than GFR, including tubular secretion, production, and additional renal elimination.[11] Obviously, diabetic foot needs a comprehensive approach to investigate and resolve all related issues.[12-14]

Accurate assessment of GFR is essential for interpreting symptoms, signs, and laboratory abnormalities that may indicate kidney disease; drug dosage; and for detecting and managing chronic kidney disease and assessing prognosis. A GFR of less than 60 ml per minute (1.73 square meters for 3 months or longer) is a diagnostic criterion for chronic kidney disease and is associated with an increased risk of adverse outcomes, including death.[15-18]

Conclusion:

It is clearly noted in our study that deteriorating renal function, measured via 24 hour urinary creatinine clearance, has a direct relationship with the development of foot ulceration. Timely recognition of reduced creatinine clearance can be helpful in the management and prevention of diabetic foot ulcers. The proposed collaborative multidisciplinary approach includes diabetologist, nephrologist and vascular surgeons.

Most studies have pointed to a link between chronic kidney disease and peripheral arterial disease. Based on our study, we hypothesized that serum urea and creatinineare not sensitive indicators for assessing renal insufficiency; therefore urinary creatinine clearance should be done for further assessment of renal function. For further confirmation of this hypothesis we need a larger sample size, more extensive and collaborative study.

Conflict of interest: None

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Role and contribution of authors:

Dr Muhammad Yahya Aziz, conceived the idea, collected the data, referecnes and drafting of article

Dr Bushra Rehman, helped in collecting the data and references and helped in introduction writing and interpretatoin of data.

Dr Ramsha Nighat, collected the references and helped in discussion and result writing.

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