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Case Report

Will controlled monitoring of biochemical profile help in better prognosis of diabetic foot ulcer?

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ABSTRACT

Diabetes Mellitus affects more than 400 million people worldwide and that number is growing rapidly. India is the country with largest number of diabetic patients in the world. Diabetic foot ulcer is one of the common causes of hospital admissions among diabetics in India.

This study was aimed at creating a database on biochemical profile of diabetic foot ulcer patients and to see if they can be used to detect and prevent progressing complications and also to monitor treatment progress.

A cross sectional study was conducted amongst 50 diabetic foot ulcer patients, biochemical parameters such as HbA1c, S. urea, S. creatinine, S. electrolytes, S. protein, S. albumin, S. SGPT, S. acetone, S. cholesterol, S. triglycerides and S. HDL were estimated from the time of hospital admission and in successive follow up.

The population study group age was between 40 to 65 years with 60 percent being males. Among 50 patients there was a relative and gradual increase in values of HbA1c, Creatinine, Cholesterol and Triglycerides. whereas there is a decrease in values observed in parameters like Protein, Albumin and Sodium.

Novel diagnostics are able to rapidly detect some of the most dangerous consequences of diabetic foot ulcer and can help to guide therapy. Therefore, preventive and evidence -based guidelines should be followed for diabetic wound management.

Take home message : Diabetic foot ulceration is a major health problem along with wound healing. Its management must also focus on identifying and correction of these biochemical changes and other contributing factors.

1. Introduction

Diabetes Mellitus affects more than 400 million people worldwide and that number is growing rapidly. India is the country with the largest number of diabetic patients in the world. Diabetic foot ulcer is one of the common reasons for hospital admissions among diabetics in India. It is the major morbidity associated with diabetes associated with pain and suffering leading to a poor quality of life for patients. According to Global Lower Extremity Amputation Study Group, 25 to 90 % of all amputations were associated with diabetes.[1,2] It is the leading cause of amputations, affecting 15% of people with diabetes. This study was aimed at creating a database on biochemical profile and general epidemiology of diabetic foot ulcer patients admitted in Civil hospital, Ahmedabad and to see if they can be used to detect progressing complications and treatment progress.[1–3]

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2. Case Report

A cross-sectional study was conducted among 50 diabetic foot ulcer patients admitted in the wards of surgery department, Civil Hospital, BJ Medical College, Ahmedabad over a period of 2 months after due permission.

Details of age, sex, duration of diabetes, treatment history, history of other comorbidities like hypertension and peripheral vascular disease was taken. Biochemical parameters such as HbA1c, S. urea, S. creatinine, S. electrolytes, S. protein, S. albumin, S.SGPT, S. acetone, S. cholesterol S. triglycerides and S. HDL were estimated within 24 hrs of hospital admission and in successive follow ups in Clinical biochemistry Lab. D10, Civil Hospital.

Venous blood was collected in clot activator serum vacutainer by venepuncture. Serum was separated by centrifugation and analysed on fully auto analyser Abbott Architect c8000. Commercially available ready to use reagent kits were used for estimation of various parameters.

3. Results

The data obtained were as follows: The population study group age was between 40 to 65 yrs. Mean age being 54yrs with 60% being males. Among 50 patients, there was a relative and gradual increase in values of HbA1c, S. creatinine, S. cholesterol and S. triglycerides. Whereas there is a decrease in values observed in parameters like S. protein, S. albumin and S. sodium. Data regarding qualitative variables are given in Table 1. and data regarding quantitative variables are given in Table 2.

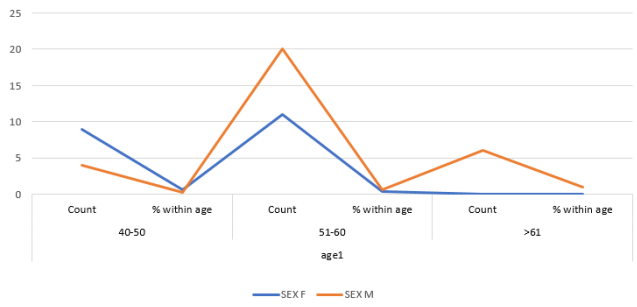

Figure 1: Gender variation

4. Discussion

Diabetic foot ulcers (DFUs) are characterized by several factors that contribute to lack of healing and transforms into non-healing wounds followed by deterioration. It is the leading cause of amputations, affecting 15% of people with diabetes. Most of the patients have poor glycaemic control on admission, mean HbA1c is 7.2+ 0.6 %. An

Table 1: Basic epidemiological data of study subjects

Parameter	Number
Age	40 to 65 yrs
Sex	
Male	60%
Female	40%
History of alcohol consumption:	
Yes	53%
No	47%
History of tobacco consumption:	
Yes	69%
No	31%
History of smoking:	
Yes	38%
No	62%
History of Hypertension:	
Yes	40%
No	60%
Presence of PVD:	
Yes	35%
No	65%
Treatment History:	
Insulin	70%
OHA	15%
Both	15%

Table 2: Distribution of biochemical parameters in study subjects.

Variable	Mean +/- Standard deviation
Duration of diabetes (years)	7 +/- 3
Blood Urea (mg/dL)	55+/- 11
Serum creatinine (mg/dL)	1.2 +/- 0.6
HbA1c (g%)	7.2 +/-0.6
Total cholesterol (mg/dL)	158 +/- 39
High density lipoprotein (mg/dL)	52 +/- 10
Triglycerides (mg/dL)	179 +/- 34
Sodium (mmol/L)	131 +/- 2.7
Potassium (mmol/L)	4.5 +/- 0.6
SGPT (IU/L)	42 +/- 9
Serum Total Bilirubin (mg/dL)	0.3 +/- 0.09
Serum Total protein (g/dL)	5.1 +/- 0.6
Serum Albumin (g/dL)	2.5 +/- 0.27
Serum Acetone	
Normal	80%
Mild	10%
Moderate	0%
High	10%

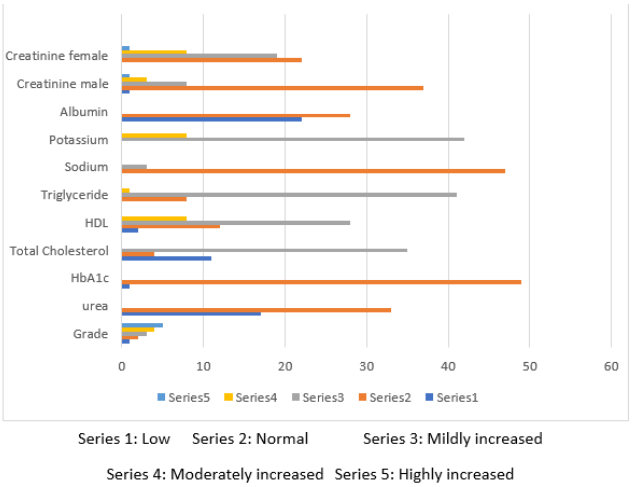

Figure 2: Parameters

increase in HbA1c by 1% can result in more than 25% risk of peripheral arterial disease.[4] Our data shows that mean serum creatinine level of these subjects are 1.2 mg/dl and serum sodium 131 mmol/dl, which indicates the possibility of kidney dysfunction associated with diabetic foot ulcer. Progressive alteration in renal function is also noticed in these subjects over the course of 2 months of observation. Serum Acetone levels in these subjects vary from normal to severe depending upon the level of glycaemic control and term of medical management, normal being 80% of cases. In this study,70 % patients are on insulin and 15% are on both OHA and insulin and 15% on OHA. People who use insulin are at higher risk of developing a foot ulcer, as are patients with diabetes-related kidney, eye, and heart disease. Being overweight and using alcohol and tobacco also play a role in the development of foot ulcers. The level of serum cholesterol and triglycerides are higher in this group of patients, whereas serum protein and albumin are on the lower side. This finding can be corelated to the fact that being a metabolic disorder, diabetes mellitus causes alteration in these parameters, there is mobilisation of free fatty acids and protein breakdown, which in turn indicates further disease progression. As far as gender parameters are concerned, men are affected more as compared to women. Also, women are found to be affected more in the perimenopausal age. Identification and correction of these biochemical alterations can be a solution for better disease prognosis and should therefore be considered. Therefore, there is an urgent need to bridge the gap that often exists between laboratory research and clinical practice.[1,5–8]

5. Conclusion

Diabetic foot ulceration is a major health problem. Along with wound healing, its management must also focus on identifying and correction of these biochemical changes and other contributing factors which might delay the process. Chronic wounds are rising in prevalence which creates significant socioeconomic burden for patients and healthcare systems worldwide. Novel diagnostics are able to rapidly detect some of the most dangerous consequences of diabetic foot ulcer and can help to guide therapy. Therefore, it is important to follow preventive and evidence-based guidelines for wound-care. Patients must be educated about its risk factors and importance of proper foot care and hygiene, which in turn will help in preventing further complications. Primary care providers should understand the mechanisms mediating resistance so that the full potential of rapid diagnostics are achieved to beneficially impact patient care.

6. Scope of Improvement

Other recommended tests that would be helpful for better diagnosis and faster treatment would be bacterial swab culture, Biomarker detection i.e. NADH, flavin (metabolic), Porphyrin, Pyoverdine (Infectious). Correction of these biochemical alterations and it's regular follow-up can help with developing a more detailed treatment approach.Also, continuous assessment of wound size, CRP levels, interleukins, procalcitonin, and follow up effects of topical oxygen therapy would also be recommended.

7. Source of Funding

None.

8. Conflict of Interest

None.

References

1. Beldeu S. Fundamental biochemical and pathogenic factors in diabetic foot ulcers and gangrene - The role of nanobiotechnology to accelerate healing and regeneration without debridement; 216.
2. Li X, Xiao T, Wang Y, Gu H, Liu Z, Jiang Y, et al. Incidence, risk factors for amputation among patients with diabetic foot ulcer in a Chinese tertiary hospital. *Diabetes Res Clin Pract*. 2011;93(1):26–30.
3. Menke NB, Ward KR, Witten TM, Bonchev DG, Diegelmann RF. Impaired wound healing. *Clin Dermatol*. 2007;25(1):19–25.
4. Tehan P, Linton C, Norbury K, White D, Chuter V. Factors contributing to wound chronicity in diabetic foot ulceration. *Wound Pract Res*. 2019;27(3):111–5.
5. Diabetic wound care, American Podiatric Medical Association ;Available from: https://www.apma.org/patients-and-the-public/conditions-affecting-the-foot-and-ankle/diabetic-wound-care/.
6. Goldin A, Beckman JA, Schmidt AM, Creager MA. Advanced glycation end products sparking the development of diabetic vascular injury. *Circulation*. 2006;114(6):597–605.
7. Vishwanathan V, Thomas N, Asirvatham A, Rijashekar S. Profile of diabetic foot complications and its associated complications–a multicentric study from India. *J Assoc Physicians India*. 2005;53:933–6.
8. Alberti K, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and

classification of diabetes mellitus provisional report of a WHO consultation. *Diabet Med*. 1998;15(7):539–73.

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