IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 9 Ser.6 (September. 2023), PP 21-26
www.iosrjournals.org

Elevated Glycated Hemoglobin, A Beacon For Grave Gangrenes

Dr.S.Prasanna Manickam, Dr.R.J.Sree Charan, Dr.V.Govindharaj
Department Of Plastic Surgery
Chengalpattu Government Medical College And Hospital

Abstract
Diabetic foot ulcer (DFU) is one of the most serious complications of diabetes mellitus.DFUs result from a complex interaction of a numerous risk factors. Once the protective layer of skin is broken, deeper tissues are exposed to micro organisms and the infection progresses rapidly. These patients frequently require amputation of the lower limbs and, in more than half of the cases, infection is the predominant causative factor. We conducted this study to predict the outcome and prognosis of diabetic foot ulcer based on clinical, microbiological and biochemical parameters.

Keywords: *Diabetic foot ulcer,Diabetes mellitus,Diabetic foot prognosis,Amputation* ***INTRODUCTION***

Date of Submission: 14-09-2023 Date of acceptance: 24-09-2023

Diabetes mellitus is a metabolic disorder which is characterised by prolonged hyperglycemia with disturbances in the metabolism of carbohydrate, fat and protein due to defects in insulin secretion, insulin action or both. Diabetes is accompanied by progressive tissue damage secondary to both micro and macrovascular complications.[1] According to the world health organization (WHO), at least 171 million people in the world have diabetes. The figure is expected to double by 2030. Diabetic foot ulcer (DFU) is one of the major complications of diabetes mellitus. Diabetic foot problems like ulcers, infections, gangrene, are the most frequent cause of hospitalization among diabetic patients.[2] Routine care of the ulcers, management of infections, amputations, and prolonged hospitalizations place a tremendous burden on the health care system every year.[3]

Wound healing is an innate mechanism by which skin or other body tissue repairs itself after trauma. An important feature of wound healing is repair of lost extracellular matrix (ECM) that forms the largest component of the dermal skin layer.[4] But in some cases, certain disorders or physiological insult interfere with the wound healing process. Diabetes mellitus is one such metabolic disorder that hinders the normal steps of the wound healing.

Various studies show an extended inflammatory phase in diabetic wounds, which causes a delay in the formation of mature granulation tissue.[5] Transient hypoxia after injury stimulates angiogenesis and promotes wound healing but persistent hypoxia deprives wounded tissues of the much needed oxygen driven metabolism to progress through the stages of wound healing by increasing the amount of free radicles arresting the process in the inflammatory phase, ergo predisposing to infections.[6] Treatment of diabetic foot ulcers should include control of blood sugar, removal of dead tissue from the wound, regular dressings, and removing the pressure on the wound through various surgical procedures.[7] Diabetic foot ulcer occurs in 15% of people with diabetes and precedes 84% of all diabetes - related lower limb amputations. In our country, the prevalence of diabetic foot ulcers was assessed to be 3.6%.[8] Socio - cultural practices such as walking bare foot, using improper foot wear and lack of awareness regarding foot care contribute towards the increased prevalence of foot related complications in India. If left untreated they result in lower extremity amputations. Diabetic foot ulcers should be treated effectively to improve the quality of life. Topical treatment is an important mode of treatment of diabetic foot ulcers albeit secondary to surgical and systemic care.

I. OBJECTIVES

-To assess the prevalence of various presentations of diabetic foot
-To study the microbiological and the biochemical parameters of this disease and interventions resorted to.
-To study in specific the role of HbA1c as a marker for poor clinical outcome.

II. METHODOLOGY

This prospective study was done on 75 patients in department of surgery at Saveetha medical college,Tamilnadu in the period of April 2017 to May 2018.The study group included diabetic male and female patients over 45 years of age. Patients with similar demographic profile but with ulcers of venous, neuropathic or congenital vascular pathology were excluded. Relevant history was obtained and clinical assessment of the peripheral neurovascular system was done. Arterial compromise gaged clinically was followed by arterial doppler/duplex study and bone involvement necessitated xray/ct of foot. Microbiological investigation namely pus/ wound swab for culture and sensitivity was done. Biochemical parameters namely haemoglobin,HbA1c of patients with various wagner grade of diabetic were studied.The clinical,radiological findings and laborartory data dictated either conservative management or surgical intervention. All data collected were entered into Excel and statistical analysis was done.

III. RESULTS

DEMOGRAGHIC DISTRIBUTION

TABLE1.1 AGE DISTRIBUTION

AGE	NUMBER OF CASES	PERCENTAGE
40-45	4	5%
46-55	39	52%
56-65	26	35%
66-75	6	8%
TOTAL	75	100%

Most of the diabetic patients (52%) belonged to the age group of 46-55 years.

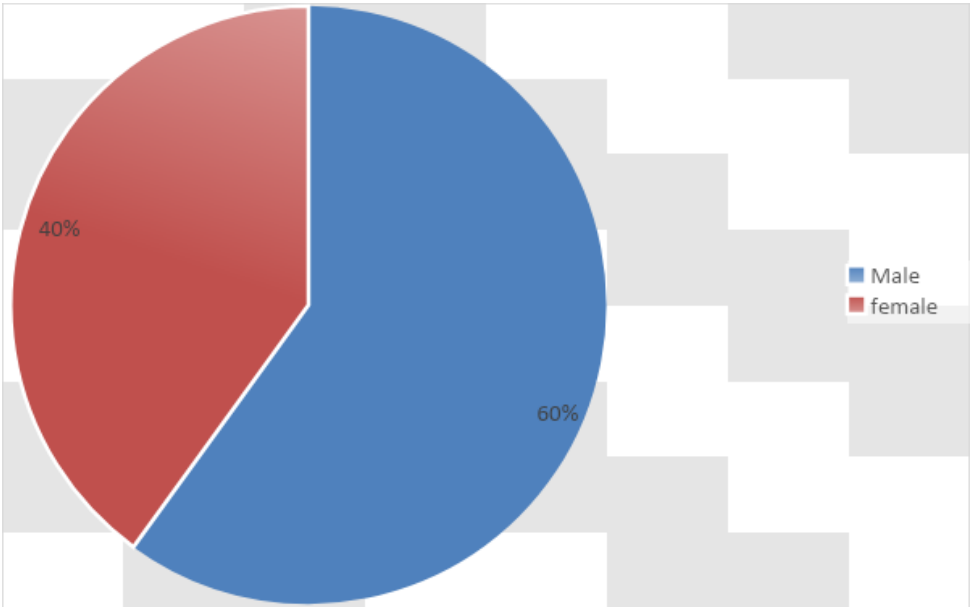

FIGURE1.1 SEX DISTRIBUTION

Male preponderance was observed in the occurrence of diabetic foot ulcer.

CLINICAL PRESENTATION

TABLE2.1 SITE OF LESION

SITE OF LESION	NUMBER OF CASES	PERCENTAGE
Dorsum of the foot	18	24%
Foot and leg	8	10.66%

Toes	45	60%
Sole	4	5.33%
TOTAL	75	100%

The toe was involved in majority (60 %) of patients followed by dorsum of foot.

TABLE2.2 TYPE OF LESION

LESION	NUMBER OF CASES	PERCENTAGE
Cellulitis	12	16%
Non healing ulcer	35	47%
Abscess	18	24%
Gangrene	10	13%
TOTAL	75	100%

Most common presentation (47%) was non-healing ulcer followed by abscess. Grave gangrenes were the least observed among these patients.

RADIOLOGICAL FINDINGS

TABLE3.1

FINDINGS	NUMBER OF CASES	PERCENTAGE
ARTERIAL DOPPLER (MONOPHASIC FLOW)	17	22.6%
X-RAY FOOT (OSTEOMYELITIC CHANGES)	23	30.6%

Arterial doppler showed monophasic flow in 22% of patients. X-ray foot showed osteomyelitic changes in 30.6% of patients.

MICROBIOLOGICAL STUDY

TABLE4.1 MICROBIOLOGICAL GROWTH

MICRO ORGANISM	CULTURE SWABS
Staphylococcal aureus	29
Klebsiella	21
Pseudomonas aeruginosa	16
E.coli	19
Proteus vulgaris	11
Enterococcus species	4
MRSA	3
Proteus mirabilis	7
Coagulase negative staph .aureus	9
Streptococcus pyogens	13
Candida	4
Coliform	3
Acinetobacter species	6

Non fermenting gram negative bacilli	3
Citrobacter	5
Sterile	3
TOTAL NO OF SWABS TAKEN	156

24 cases showed polymicrobial growth.Staphylococcus aureus, klebsiella species pseudomonas aeruginosa and E.coli were the most common organisms of diabetic foot infection.

TABLE4.2 ANAEROBIC GROWTH AMONGST GANGRENOUS FOOT

	NUMBER OF PATIENTS WITH GANGRENOUS FOOT	**PERCENTAGE**
POLYMICROBIAL GROWTH WITH ANAEROBIC GROWTH	**6**	**75**
POLYMICROBIAL GROWTH WITHOUT ANAEROBIC GROWTH	**2**	**25**
TOTAL	**8**	**100**

TABLE4.3 ANAEROBIC GROWTH AMONGST NONGANGRENOUS DIABETIC FOOT

	NUMBER OF PATIENTS	**PERCENTAGE**
POLYMICROBIAL GROWTH WITH ANAEROBIC GROWTH	9	56.25
POLYMICROBIAL GROWTH WITHOUT ANAEROBIC GROWTH	7	43.75
TOTAL	16	100

75% of patients with gangrene showed polymicrobial growth with anaerobic growth,whilst only 56.25% of patients with non-gangrenous presentation(cellulitis,non-healing ulcer,abscess) showed anaerobic involvement.

BIOCHEMICAL PARAMETERS

TABLE 5.1

INVESTIGATION	**NUMBER OF CASES**	**PERCENTAGE**
HB%(< 7%)	27	36%

36% of patients had decreased haemoglobin (< 7%).

TABLE5.2 DISTRIBUTION OF HbA1C

HbA1C	**NUMBER OF PATIENTS**	**PERCENTAGE**
>8	46	61.33
<8	29	38.66
	75	100

61% of patients had HbA1C more than 8

TABLE 5.3DISTRIBUTION OF HbA1C AMONGST PATIENTS WITH GANGRENOUS PRESENTATION

	NUMBER OF PATIENTS	PERCENTAGE
HbA1C >8	7	70
HbA1C<8	3	30
TOTAL	10	100

TABLE 5.3DISTRIBUTION OF HbA1C AMONGST PATIENTS WITH NON GANGRENOUS DIABETIC FOOT

	NUMBER OF PATIENTS	PERCENTAGE
HbA1C>8	39	60
HbA1C<8	26	40
	65	100

70% of patients with gangrenous foot had elevated HbA1c (>8), whilst 60% of patients with non-gangrenous diabetic foot had similar glycaemic status.

TREATMENT

TABLE6.1 NATURE OF TREATMENT

TREATMENT	MUQUIM RU	KHAN	PRESENT STUDY
Conservative	17	42	56%
Surgical	83	33	44%

More than half the patients (56%) were treated conservatively with wound debridement and dressing .The rest 44% were treated surgically with serial wound debridement,skin grafting and amputation.

TABLE6.2 TYPE OF SURGERY

TREATMENT	MUQUIN RU	KHAN AH	PRESENT STUDY
Minor	72	140	24
Major	11	17	9

Majority (73%)of the surgical interventions done were minor which includes fasciotomy, serial wound debridement and skin grafting whereas the remaining underwent major surgical procedures such as disarticulation and transmetatarsal/ below knee /above knee amputations.

IV. DISCUSSION

Diabetes is a chronic metabolic disease characterized by elevated blood sugar.This non communicable disease results in serious micro and macro vascular complications. Most of the diabetic patients (52%) belonged to the age group of 46-55 years, albeit younger age groups are not spared. Male preponderance was observed in the occurrence of diabetic foot ulcer in this study, whereas in Mayfield study male: female ratio was almost equal.[9] This study found non healing ulcer to be the most common presentation. Neuropathy is the most common pathology and patients with neuropathy are more prone for the development of diabetic foot. This is in agreement with the results of Margolis DJ study.[10] Staphylococcus aureus and klebsiella were the most common gram positive and gram negative mirobes isolated from wound swab cultures respectively. Anaerobic growth was found predominantly in gangrenous diabetic foot. 36% of the patients had decreased haemoglobin (< 7%) and 61.33% had HbA1c more than 8. 70% of patients with gangrenous foot had HbA1c more than 8. Several studies have found that glycated haemoglobin strongly binds to oxygen decreasing oxygen availability to tissues favouring anaerobiosis.[11] Anaerobic growth has been attributed to the worst clinical outcome that requires amputation to halt ascending sepsis,and thus uncontrolled glycemic status marked by elevated glycated Hb eventually results in the worst clinical outcome. The intervention resorted to depends on the severity of

clinical presentation of diabetic foot. This is in turn reflective of patient's level of adherence to strict diabetic control and foot care. More than half the patients(56%) had undergone wound debridement and dressing .The rest 44% were treated surgically with serial wound debridement, split skin grafting and by amputations. This is comparable with MUQUIM RU and Khan AH study.[12] Mortality was observed in 2 patients who underwent BK amputation due to uncontrolled diabetes, sepsis, old age, poor immune status. Several studies have found mortality rates to be higher among diabetics with diabetic foot complications than in those without it. This study found both elevated HbA1c and anaerobic growth to be most commonly associated with worse Wagner grades of diabetic foot. Thus it can be inferred that anaerobiosis favouring worst clinical outcome (gangrenes which eventually get amputated) was accentuated by poor dissociation of oxygen from the glycated haemoglobin. A study conducted in the UK had tried to improve the oxygen availability in the wound bed by using a topical haemoglobin spray which binds to the oxygen in the atmosphere and releases it in the wound bed. This novel approach accelerated the healing of diabetic foot.[6]Thus research on novel, feasible approach to increase oxygen tension could help in saving several dying foot.

V. CONCLUSION

Diabetes is a lifelong problem, and the incidence of diabetic foot complications increases with age and duration of the disease. Diabetic patients at risk for foot lesions must be educated about risk factors and the importance of foot care, including the need for self-inspection and surveillance, monitoring foot temperatures, appropriate daily foot hygiene, use of proper footwear, good diabetic control, prompt recognition and professional treatment of newly discovered lesions. Behavioural change effected at community level can help achieve this. This study found incessant elevated blood sugar marked by HbA1c to result in the worst clinical outcome paired with poor recuperation when left unheeded. Ergo,a wholistic approach encompassing medical, surgical interventions with behavioural modifications can help curb this malign upheaval.

REFERENCES

[1]. Joslin, Elliott Proctor, And C. Ronald Kahn, Eds. Joslin's Diabetes Mellitus: Edited By C. Ronald Kahn...[Et Al.]. Lippincott Williams & Wilkins, 2005.

[2]. Apelqvist, J., K. Bakker, W. H. Van Houtum, M. H. Nabuurs-Franssen, And N. C. Schaper. "International Consensus And Practical Guidelines On The Management And The Prevention Of The Diabetic Foot." Diabetes/Metabolism Research And Reviews 16, No. S1 (2000): S84-S92.

[3]. Kruse, Ingrid, And Steven Edelman. "Evaluation And Treatment Of Diabetic Foot Ulcers." Clinical Diabetes 24, No. 2 (2006): 91-93.

[4]. Nomikos, Iakovos N., Constantinos Malizos, And Nicholas C. Vamvakopoulos. "Protective And Damaging Aspects Of Healing: A Review." WOUNDS-A COMPENDIUM OF CLINICAL RESEARCH AND PRACTICE 18, No. 7 (2006): 177-185.

[5]. . Mclennan, S., D. K. Yue, And S. M. Twigg. "Molecular Aspects Of Wound Healing In Diabetes." Primary Intention: The Australian Journal Of Wound Management 14, No. 1 (2006): 8.

[6]. Hunt, Sharon D., And Fredrik Elg. "Clinical Effectiveness Of Hemoglobin Spray (Granulox®) As Adjunctive Therapy In The Treatment Of Chronic Diabetic Foot Ulcers." Diabetic Foot & Ankle 7, No. 1 (2016): 33101.

[7]. Yazdanpanah, Leila, Morteza Nasiri, And Sara Adarvishi. "Literature Review On The Management Of Diabetic Foot Ulcer." World Journal Of Diabetes 6, No. 1 (2015): 37.

[8]. Pendsey, Sharad P. "Understanding Diabetic Foot." International Journal Of Diabetes In Developing Countries 30, No. 2 (2010): 75.

[9]. Mayfield, Jennifer A., Gayle E. Reiber, Lee J. Sanders, Dennis Janisse, And Leonard M. Pogach. "Preventive Foot Care In People With Diabetes." Diabetes Care 21, No. 12 (1998): 2161-2177.

[10]. Margolis, David J., Lynne Allen-Taylor, Ole Hoffstad, And Jesse A. Berlin. "Diabetic Neuropathic Foot Ulcers: Predicting Which Ones Will Not Heal." The American Journal Of Medicine 115, No. 8 (2003): 627-631.

[11]. Pu, Li Jin, Ying Shen, Lin Lu, Rui Yan Zhang, Qi Zhang, And Wei Feng Shen. "Increased Blood Glycohemoglobin A1c Levels Lead To Overestimation Of Arterial Oxygen Saturation By Pulse Oximetry In Patients With Type 2 Diabetes." Cardiovascular Diabetology 11, No. 1 (2012): 110.

[12]. Raja, Nadeem Sajjad. "Microbiology Of Diabetic Foot Infections In A Teaching Hospital In Malaysia: A Retrospective Study Of 194 Cases." Journal Of Microbiology Immunology And Infection 40, No. 1 (2007): 39.

[13]. Griffin, Samson, And Mukhtar Ahmed. "EVALUATION AND MANAGEMENT OF DIABETIC FOOT ACCORDING TO WAGNER'S CLASSIFICATION A STUDY OF 100 CASES." Journal Of Ayub Medical College Abbottabad 15, No. 3 (2003).