

MANAGEMENT OF DIABETIC FOOT ULCER IN AL-HUSSEIN TEACHING HOSPITAL / SAMAWA

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Abstract

Background : Globally, Diabetes Mellitus is a common health problem that occurs as a systemic disease affecting vascular, nervous, skeletal, immune, and integumentary systems.

The aim: The aim of this study is to evaluate and highlight on the management outcome of diabetic foot in AL-Hussein Teaching Hospital – Samawa / AL-Muthanna province and determine the risk factors adversely affecting the treatment prognosis.

Patient and Methods: Fifty patients diagnosed with Diabetic Foot Ulcer (DFU) ulcer were included in this study. The lesions were managed by removing dead tissue, triple antibiotic therapy, avoiding weight bearing, and proper diabetes control.

Results: According to gender, the percentage of DF was 34 (68%) and 16 (32%) for males and females, respectively. Moreover, the results showed that 22 (44%) and 28 (56%) display type I and type II DM, respectively. Also, 23 out of 50 (46%) patients were poorly controlled, and ten of these cases (43%) underwent amputation. According to Wagner Grading System; the patient's grade percentages were 2%, 30%, 20%, 22%, 14%, and 12 % for Grade 0, Grade I, Grade II, Grade III, Grade IV, and Grade V, respectively. All non-responded patients were those treated at home, had poor cooperation, neglect, and out-patient follow-up refusal and were subjected to amputation. The poorly controlled or uncontrolled DM, Ischemic heart disease (IHD), leukocytosis, anemia, impalpable dorsalis pedis pulse/s, smoking, neuropathy, patient's neglect and traditional home treatment were the common factors that revealed significant adverse effects on conservative treatment. While hyperglycemia, hypertension and site of management (surgical, orthopedic, out-patient or emergency departments) factors that revealed less or non-significant adverse effects on conservative treatment.

Conclusion: this study showed that type II DM was the most diabetic foot lesion. The study also approved that most patients were poorly controlled DM that ended with amputation, and most patients presented with Wagner's grade I.

Keywords: Amputation, Diabetes Mellitus, Wagner Grading System.

Introduction

Diabetes Mellitus is a worldwide public health concern, impacting a severe universal burden on public health and socio-economic growth¹. Diabetic foot is an important complication that significantly burdens public health since the patients suffer from disabilities. Additionally, the direct and indirect costs related to this condition^{2,3}. The diabetic foot is a term that refers to any pathological changes in the foot that result from diabetes or its long-term complications⁴. It refers to the combination of ischemia, neuropathy, and an immune-compromised state that renders the feet of diabetic patients particularly susceptible to sepsis, ulceration, and gangrene⁵.

Many researchers reported variations in the occurrence of diabetic foot ulcers, it was 8-15% in high-income nations, and 85% of amputations are preceded by an ulcer^{3,6}. Foot ulcers are the most serious consequences, which are frequently liable to be infected with potentially devastating progression to deeper tissues. Suppose the diabetic foot is not estimated and treated correctly early and appropriately; in that case it might become incurable and lead to progressive tissue necrosis and gangrene which mandate surgical intervention like debridement or amputation of the affected part or limb⁷. Although the importance of this condition limited control and prevention activities are undertaken to reduce its concerns at primary care health centers⁸. Several management procedures are applied for diabetic foot ulcers. These are included the removal of callus skin, eradication of the infection by triple antibiotic therapy, avoidance of weight bearing, proper diabetes control, controlling edema and application of

angiography to assess the feasibility of vascular reconstruction in selected cases⁹.

According to the International Working Group of Diabetic Foot (IWGDF) the ulceration risk was categorized by grouping focused on the patient's education and aimed at the patient's self-care⁶.

Diabetic foot is a widespread complication among Iraqi diabetes mellitus patients^{11,12}. It is considered the utmost common health problem with highly prevalent, especially in different Iraqi diabetic patients¹², accompanied by significant morbidity^{13,14}. A literature review revealed scarce publications regarding the management processes of the diabetic foot and its outcome. Consequently, this study intends to evaluate the management outcome of diabetic foot in AL-Hussein Teaching Hospital – Samawa / AL-Muthanna province/ Iraq and to clarify and assess the risk factors that adversely influence treatment prognosis.

Patients and methods

This study was approved by the ethical and research committee/ College of medical sciences/ Al Muthanna university. Moreover, all patients signed the consent form designed for this study. A prospective study was conducted on 50 patients diagnosed with the diabetic foot at Al-Hussein Teaching Hospital. The selection of patients based on including those patients having clinically evident diabetic foot lesion [diabetic foot ulceration, infection or gangrene]. Each patient was interviewed and all personal data was registered including name, age, sex, type of DM and its duration with the type of antidiabetic therapy, site of management (surgical, orthopedic, or out-patients department), date of admission, Wagner grade, oral health and smoking habit, random

blood sugar level, HbA1C value, Hb value and WBC count.

Moreover; medico-surgical history with physical examination and vital signs considering state of distal pulsations (dorsalis pedis DP and posterior tibial PT pulses) were also observed accompanied by lower limb sensory motor function assessment. The patient's criteria recorded such as hypertension, anemia, hyperglycemic and leukocytosis if the measurement were 140/90 mmHg, Hb <10mg/dl, level >200mg/dl and WBC count was >11000/cc respectively. Moreover, cardiologists have to approve the ischemic heart disease and neuropathy by medico-surgical neurological assessment.

However amputation of diabetic foot requires one or more of the following criteria: the rapidly spreading lesion, infection with tissue necrosis despite aggressive medical and/or surgical limb conserving measures; gangrene; absent pedal pulses, severe pain; increasing fever (sepsis) and increasing need for insulin.

The risk of critical diabetic foot complications was categorized into four

groups. According to predicting ulcer occurrence, these groups were 5.1%, 14.3%, 18.8 and 55.8%, at 3 years of follow-up for R0, R1, R2, and R3, respectively ¹⁰. All patients were assessed carefully before starting treatment plan. Different options were used for the management of those patients such as the outpatient or admitted (if indicated) at a special ward and treated either conservatively by proper blood sugar control, eradication of infection, correction of anemia and dietary manipulation or operatively by the surgeon for debridement of necrotic tissues with daily dressing change under aseptic measures and even sometimes radical treatment as mapped amputation after counseling the plan with the patients and their relatives with signed consent.

Data were analysed through the use of statistical package of social science (SPSS) virgin 23;

1.Descriptive statistics [frequency and percentage].

2. Inferential statistics [Chi square].

Results

Patient's demographic factors

Out of 50 diabetic foot patients there were 30 (60%), 20 (40%) for males and females respectively. The mean age of patients was 55

years (ranging from 30-80 years). Additionally; 22 (44%) and 28 (56%) patients showed type I and II DM respectively. However; the mean duration of DM was 10 years (Table. 1) (Figure. 1).

Table 1: Shows the age distribution of patients in relation to sex and location of management

Age in years	Males	Females	Outpatient clinic		Total
			Males	Females	
<50	6	5	2	3	16
=50	2	2	1	1	6
>50	15	4	4	5	28
Total	23	11	7	9	50

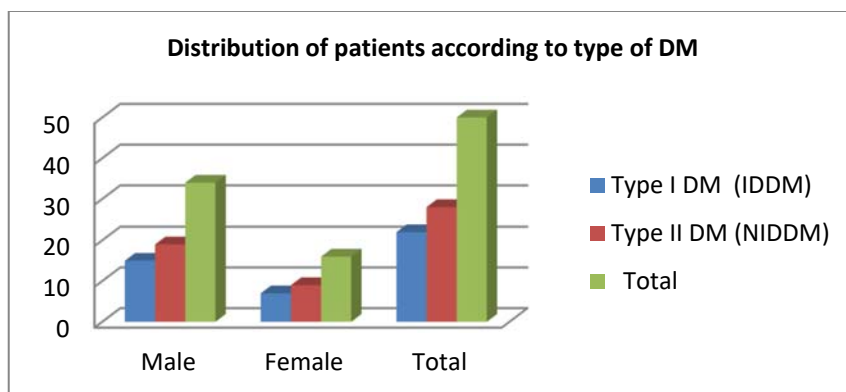


Figure 1: Shows the distribution of patients according to type of DM.

Regarding the module of treatment; 35 (70%) patients were treated conservatively satisfactorily, while 15 (30%) unfortunately underwent amputation. Additionally, according to Wagner Grade; there were 15

patients (30%), 10 (20%), 11 patients (22%), 7 patients (14%), 6 patients (12%), and 1 patient (2%) for Grade I, Grade III, Grade II, Grade IV, Grade V, and Grade 0 respectively (Table II).

Table II: Wagner grading system of the studied patients

Wagner grade	Males	Females	Total
0	0	1	1
I	11	4	15
II	6	4	10
III	8	3	11
IV	5	2	7
V	4	2	6
Total	34	16	50

This study also showed that 30% (15 out of 50) of patients underwent amputation. Moreover, the percentages of amputation

according to gender were 33% (11 out of 34 males) and 25% (4 out of 16) for males and females, respectively (Table III).

Table III: Diabetic foot grading in relation to treatment outcome (% out of total)

Wagner grade	Sex	Conservative treatment	Percentage	Amputation	Percentage	Total
0	M	0	0%	0	0%	0
	F	1	2%	0	0%	1
I	M	10	20%	1	2%	11
	F	4	8%	0	0%	4
II	M	6	12%	0	0%	6
	F	4	8%	0	0%	4
III	M	6	12%	2	4%	8

	F	2	4%	1	2%	3
IV	M	1	2%	4	8%	5
	F	1	2%	1	2%	2
V	M	0	0%	4	8%	4
	F	0	0%	2	4%	2
Total		35		15		50

Regarding pedal pulses (PT and DP); the results revealed 10 out of 50 (20%) including 8 amputated cases had impalpable pedal pulse. While the palpable PT or DP was in 40 patients (80%); only 7 cases underwent amputation. The measurement of blood sugar revealed that 76% (38 out of 50) had blood sugar >200 mg/dl, where 14 patients out of them underwent amputation. While among

12 out of 50 patients with blood sugar \leq 200mg/dl , only one patient was amputated.

Regarding the DM control the results of this study showed that 46 % (23 out of 50) of the patient including 10 cases of them got amputation (20%). While 27 patients were under control with a percentage of 54 % and included 5 cases of them got amputation (10% among all patients) (Figure 2)

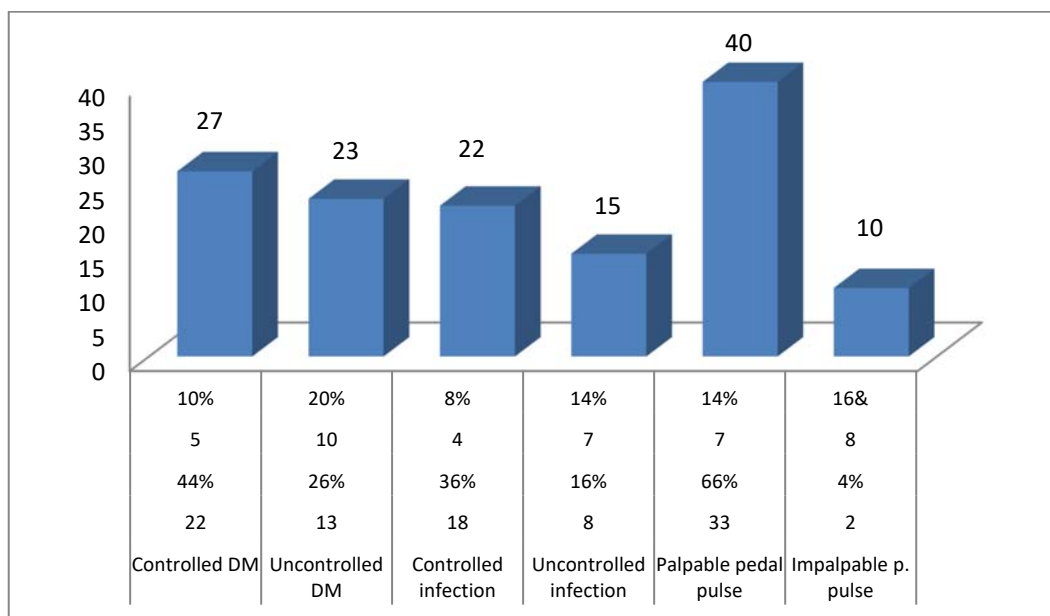


Figure 2: Shows the percentages of patient's distribution according to PT and / or DP and DM control

Additionally; 37 (74 %) out of 50 cases were showed infection including 22 cases with the controlled infection; however 4 cases were underwent amputation. Meanwhile the uncontrolled infection occurred in 15 cases included 7 amputated cases.

In regard to the smoking habit of patients there were 70% (35 out of 50 with 12 cases

of them underwent amputation) and 30% (15 out of 50 with 3 of them underwent amputation) for smokers and non-smokers respectively. While the percentages of poor and satisfactory oral health hygiene 27 (54%) and 23 (46%) respectively.

Regarding the neuropathy there were 22 cases (44%) diagnosed cases with 12 of them underwent amputation. However 28 cases

(56%) did not diagnosed with neuropathy and only 3 cases of them underwent amputation. While high blood sugar level with poor control or uncontrolled level, neuropathy,

leukocytosis (WBCs > 11000/cc), smoking and ischemic heart disease revealed significant effect and influence prognosis adversely (Table IV).

Table IV: Risk factors and type of management (% from total)

Risk factors		Conservative treatment	Percentage	Amputation	Percentage
Sex	Male	23	46%	11	22%
	Female	12	24%	4	8%
Duration of DM	<10 years	18	36%	8	16%
	>10 years	17	34%	7	14%
Type of DM	I	15	30%	7	14%
	II	20	40%	8	16%
Smoking	Yes	23	46%	12	24%
	No	12	24%	3	6%
Oral health	poor	27	54%	12	24%
	Satisfactory	23	46%	3	6%
HT	<140/90	28	56%	9	18%
	>140/90	7	14%	6	12%
IHD	Yes	7	14%	7	14%
	No	28	56%	8	16%
Hb value	<10 g/dl	17	34%	8	16%
	>10 g/dl	18	36%	7	14%
WBC	<11000/cc	21	42%	4	8%
	>11000/cc	14	28%	11	22%
Blood sugar	<200 mg/dl	11	22%	1	2%
	>200 mg/dl	24	48%	14	28%
Neuro- pathy	Yes	10	20%	12	24%
	No	25	50%	3	6%

The percentages of amputation type were 16%, 6%, and 6 % for toe amputation, below-knee amputation, and above-knee

amputation, respectively (Table V, Figure.3).

Table V: Shows the percentages of amputation in surgical and orthopedic wards

Type of amputation	Males	Percentage	Females	Percentage
Toe amputation	8	16%	0	0%
Transmetatarsal	0	0%	0	0%
Syme's	0	0%	0	0%
Below knee	1	2%	1	2%
Above knee	1	2%	2	4%

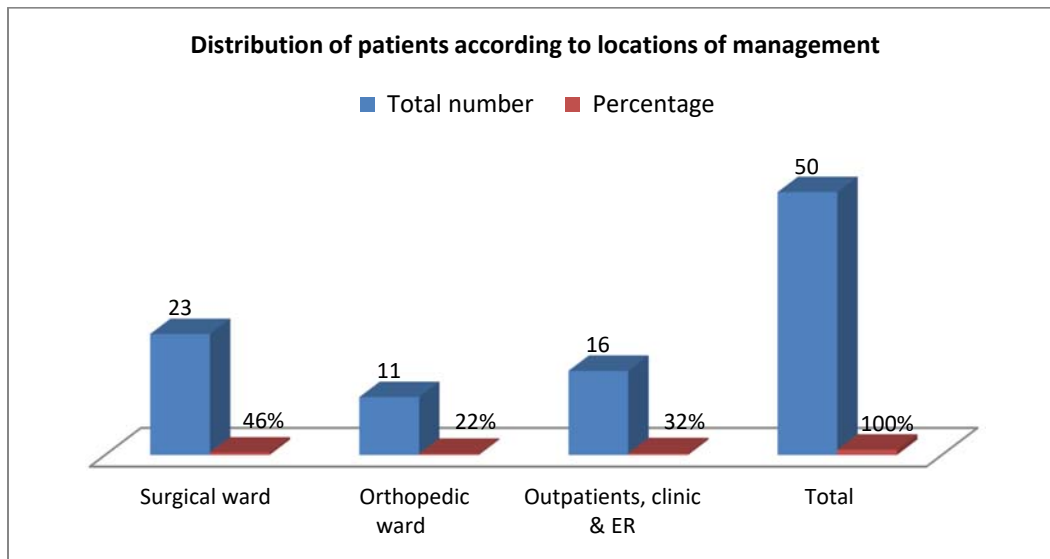


Figure 3: Shows the distribution of the patients according to the locations of the management

Discussion

Diabetic Foot problems are an important cause of mortalities in diabetes mellitus patients due to the contribution of vascular and neurological disorders¹⁵. Diabetic foot problems account for approximately two-thirds of all non-traumatic amputations performed in most developing countries^{16, 17}. Ulceration of the foot and other lower limb lesions frequently affects diabetic patients during their lifetime. History of a previous foot ulcer (according to the Wagner grading system); the presence of neuropathy; the presence of peripheral vascular disease; poor glycemic control; patient's neglect and underestimation of the foot lesions are considered as the important risk factors in the development of Diabetic Foot in patients and considered as the best predictors of future diabetic foot amputation. The results of the current study revealed the percentage of DM according to type. 56% (28 out of 50 patients) and 44%

(22 out of 50 patients) were of type II and type I, respectively. This result is compatible with previous studies reported in Iran^{17, 18}. In Iran, the researcher found that the overall prevalence of diabetes was 8.7% in people aged 15-64 years and about half (4.1%) of them were from newly diagnosed cases, according to the National CAD risk factors surveillance report^{17, 18, 19}.

The classification of patients according to Wagner grading in the current study showed that 30%, 22%, 20%, 14%, and 12% were grade I, grade III, grade II, grade IV, and grade V, respectively. Nonetheless, the higher percentages were presented with grade I. These results are compatible with the previously reported study by Noshad *et al.*, (2012)²⁰ who used the same classification system (Wagner Classification System) to predict the outcome of 50 patients. Moreover, there were 24 (48%), 13(26%), 9 (18%), and 4 (8%) patients for Grade 1, Grade II, Grade III, and Grade IV, respectively. However, no patients were graded in Grade V and Grade-0)²⁰.

The current study showed that 34 (68%) and 16 (32%) were males and females, respectively. This result agrees with the previous study ²¹ which reported a higher percentage of males than females. Furthermore, they concluded that women have a lower risk than men due to less severe neuropathy, increased joint mobility, and lower foot pressures. Nonetheless, these factors are variable and women should be considered to be at equal risk as men for developing upcoming complications. The most common site of diabetic foot ulcer was the 1st metatarsal head ²². Sensory neuropathy renders the foot susceptible to trauma because of analgesia. Motor neuropathy causes an imbalance in the foot's intrinsic musculature leading to ventral subluxation of the metatarsal heads and pressure necrosis of the planter tissue. Autonomic neuropathy may alter the microcirculation further exacerbating tissue ischemia. These observations were also reported previously by another researcher ²³. Diabetic patients with foot lesions usually occur around 50 years of age. In the current study, the percentage of cases above 50 years was 56%, with a mean age of 55. Moreover 48% of the patients (24 out of 50) presented with duration of DM of more than ten years.

The lack of awareness is important for diabetic foot care; in addition complications of DM were most probably developed after 10 years. These results are compatible with previous studies ²⁴, which approved the relationship between diabetic foot ulcers and the age of the patients. While another study revealed that patients 75 years and above showed the highest prevalence range between 51.9-81.5% ²⁵. The intensity and duration of treatment can be determined by clinical evaluation of the lesion. Moreover, the treatment outcome showed that conservative and/or surgical treatment which includes bed rest non-weight-bearing activity and simple wound debridement were successful in 100%

of grade I, 65% of grade II and 12% of grade III. In contrast the overall successful treatment was 59%. However, Ritz et al., 1992) ²⁶ reported the successful conservative treatment of up to 90% among the same grades I, II, and III. At the same time another researcher reported that the crucial factors leading to the failure of conservative treatment include retinopathy, neuropathy, and impairment of blood flow ²⁷. Socioeconomic status, traditional treatment and educational factors could be encountered as seasonal factors impacting diabetic foot ulcers in addition to lack of special aids of treatment like total contact cast or felted foam dressing which decrease pressure at the ulcer sites ²⁶ and so also haphazard usage of multi antimicrobial agents by most of our patients. In this study, the percentage of the incidence of amputation among patients was 30% (15 cases). However this percentage is considered high and might be due to the late presentation of the case. Ten cases were males (66.66%) and 5 females (33.33%). The most common type of amputation performed was toe (Ray) amputation in 10 cases among 15 patients. This might be due to the high percentage of patients who presented with toe or metatarsal head lesions; below-knee amputations in 2 cases and above-knee amputations in 3 cases. These results are compatible with previously published studies ²⁸. In the current study, most patients presented with poor glycemic control affecting the treatment outcome adversely. Unawareness about glucose level control can be explained by those patients about the importance of proper medical control of their sugar level, dietary control, and regular specialized diabetic clinic follow-up.

Peripheral vascular disease is another significant risk factor that affects DFU management. This was detected by palpating the pedal pulse, also early detection of vasculopathy by Doppler ultrasound which was significantly discovered in 10 patients

(out of 50 patients; 20%). It has been advocated that any diabetic patient at risk of amputation should have an angiography to demonstrate the need for vascular surgery to prevent or modify the degree of amputation to be performed. Neuropathy was present in 22 patients among 50 (44%). Smoking causes a substantial increase in risk for both macro- and micro-vascular diseases. Smoking is also associated with increased serum concentration of total cholesterol and LDL, a decrease in serum HDL concentration and a greater degree of insulin resistance^{26,27}. The current study revealed that smoking adversely affected the treatment outcome and considerable percentages of smokers underwent amputation (12 cases out of 50) (34.28%).

However, in this study the poor and satisfactory oral hygiene statuses were 27(54%) and 23 (46%), respectively affecting patients adversely. These results are incompatible with a previous study that reported a high percentage of 90% of diabetic patients with oral manifestation. They also found an evidence of a strong bidirectional relationship between DM and periodontal disease. Moreover they also approved that diabetic patients were unfortunately unaware of the association between the disease and oral health and the percentage of routine dental check-ups with the dentist was very small^{29, 30}.

Additionally; atherosclerosis, hypertension, ischemic heart diseases, obesity and hyperlipidemia are also considered an important factors that increase the occurrence of DFU. The current study showed that 13 cases out of 50 were hypertensive and their blood pressure was 149/90. Moreover seven hypertensive cases were treated conservatively and six cases underwent amputation. Also; 14 patients of the total had ischemic heart disease; half were treated conservatively and the other half underwent amputation. These results agree

with a previous report study approved that percentages of the risk of Pre-Hypertension and hypertension were 144 (40.4%) and 160(44.9%), respectively³¹. The current study needed to collect valuable data about antimicrobial effects on the management outcome because of the wide usage of antibiotics by the patient without prescription. Therefore, most patients in this study revealed multi-antibiotic resistance in the antibiotic sensitivity test; as this observed clinically by no response to the usual antibiotic triple regimen with subsequent complicating infectious complications of DF. However, the antimicrobial effects on management outcomes were reported in a previous study done by Jordanian diabetic foot surgeons on 100 patients. The patients were divided into 4 groups using a different antimicrobial agent with an average admission day (7-14 days). They found 5 cases complicated with infection and septicemia, 15 cases got amputated, and 5 patients developed acute renal failure. They recommended using antimicrobial agents only after accurate culture and sensitivity testing³² and so also we recommend in our study a proper valuable usage of antimicrobial regimen should be based on an adequate culture and sensitivity testing of a swabs taken from the lesion of DF.

Conclusion

In conclusion this study showed that most diabetic foot lesion patients were type II DM. Most patients were poorly controlled DM that ended with amputation and most patients presented with Wagner's grade I. Moreover, the most common site of diabetic foot ulceration was the head of the first metatarsal bone. While the most common type of management performed was surgical, whether debridement or amputation (simple or major). Early diagnosis is very important for successful conservative management.

Age, gender, oral health hygiene, smoking, and other relevant factors were important risk factors in developing diabetic foot ulcers. The authors recommend doing more future studies on diabetic foot in different provinces of Iraq and studying more critical risk factors that promote the development of diabetic foot

in DM patients to establish the most role and regime to control the incidence of this complication

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Authors' Contributions:

Author 1 - Conception, Design, Materials, Data Collection, Writing

Author 2 - Writing, Literature Review

Author 3 - Writing, Analysis And Interpretation, Literature Review

All authors have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

Availability of Data and Material:

The corresponding author is prompt to supply datasets generated during and/or analyzed during the current study on wise request.

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