Predictors of intra-hospital mortality in patients with diabetic foot ulcers in Nigeria: data from the MEDFUN Study.

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Abstract

Background/Objective : Diabetic foot ulcers (DFU) are associated with high morbidity and mortality globally. Mortality in patients hospitalized for DFU in Nigeria is unacceptably high. We sought to document contributory factors which predict mortality in patients hospitalized for DFU.

Methods : Multi-centre Evaluation of Diabetic Foot Ulcer in Nigeria (MEDFUN), one-year observational study conducted in six tertiary healthcare institutions across the 6 geopolitical zones of Nigeria. Consecutive type 1 or 2 diabetic patients hospitalized for DFU who consented. Co-morbid complications were documented.

Results : Mean age 55.9 $\pm$ 12.5 years. 96.1% had type 2 diabetes (DM), mean duration of DM was 8.5 ± 5.7 years. Duration of ulcer was 39 days with a range of 28 to 54 days. 79.2% presented with at least grade 3 DFU. About one-fifth of the patients died (20.5%). Highest mortality among subjects with Wagner grade 5. Middle-aged subjects (45-64 years) had significantly higher mortality- odds ratio (OR) 5.107, Confidence interval (CI) of 1.429-18.252, and P-value 0.022. Variables significantly associated with mortality with the respective p- values are DM duration more than 120 months (0.008), ulcer duration > one month (0.013), ulcer severity of Wagner grade 3 and above (0.001), peripheral arterial disease (0.002), foot gangrene (< 0.001). Laboratory variables associated with mortality ; proteinuria (<0.001), positive blood cultures (<0.001), severe vascular stenosis (0.001), moderate vascular stenosis(< 0.001), Low HDL (< 0.001). Co-morbid complications significantly associated with mortality; shock at presentation (<0.001), anemia (0.034), cardiac failure (0.020), renal impairment (<0.001). Sepsis was the strongest predictor of mortality (adjusted OR 5.128; 95% CI 2.614 – 10.060) followed by renal impairment (adjusted OR 2.831; 95% C.I. for OR 1.346 – 5.953).

Conclusions : Mortality among Nigerian diabetic patients admitted for DFU is high, univariate predictors of mortality: older age, higher Wagner grade (≥ 3) ulcer, longer duration of DM, longer duration of ulcer, peripheral arterial disease, foot gangrene, renal impairment, low HDL- cholesterol, anemia, shock, and cardiac failure. Renal impairment and positive blood culture were independent determinants of mortality.

Background

Diabetic foot ulcer (DFU) is one of the most debilitating chronic complications of diabetes mellitus (DM) and its prevalence is increasing exponentially across the globe. The number of people with diabetes worldwide is currently estimated to be 425 million with this number projected to increase to 629 million by year 2045.¹ The implication of this increase is a corresponding rise in micro and macrovascular complications of the disease. Every thirty seconds, a lower limb or part of it is lost to amputation as a consequence of diabetes globally.² Diabetic foot ulcer is characterized by poor short and long term survival especially when associated with other microangiopathic comorbidities.²⁻⁶ Mortality in the hospitalized diabetic patient with DFU is quite considerable compared to those without. One of the

commonest causes of death among hospitalized diabetic patients is DFU. Mortality due to DFU was reported to be 14% in Africa and 40.5% in a cohort of Nigerians.⁷⁻⁹ Although there is paucity of data regarding the factors associated with intra-hospital mortality in Nigerian patients with DFU, reports from other parts of the world indicate that lower extremity amputation (LEA) conferred a higher risk of mortality.⁶ Malnutrition, confirmed using a geriatric nutritional assessment risk index was found to be associated with a higher mortality among patients admitted for DFU in concert with older age and reduced glomerular filtration rate.^{10, 11} Site of osteomyelitis (hind versus mid/forefoot) was a determinant of higher mortality in a cohort of DFU patients in Arezzo, Italy.¹² Other factors that promote higher risk of mortality in patients hospitalized for DFU are a raised white cell and neutrophil count, ulcer severity at presentation and anemia.^{7, 13, 14} Given the currently unacceptably high mortality in patients admitted for DFU in Nigeria,⁷ it is important to identify contributory factors which will predict outcome in this group of patients. Identification of these factors will enable optimized management strategy and stem this tide of high DFU related mortality. Prognostic predictors will identify patients in need of more intensive monitoring and treatment. We, therefore, sought to document those factors associated with mortality in patients admitted for DFU in Nigeria.

Methods

The Multi-centre Evaluation of Diabetic Foot Ulcer in Nigeria (MEDFUN) was a one-year observational study conducted in six tertiary healthcare institutions across Nigeria, from March 2016 to April 2017. The centres included Lagos State University Teaching Hospital (Southwest Nigeria), Enugu State University Teaching Hospital (Southeast Nigeria), Aminu Kano Teaching Hospital (Northwest Nigeria), Ahmadu Bello University Teaching Hospital Zaria (Northwest Nigeria), Federal Medical Centre Keffi (North Central Nigeria) and Federal Medical Centre Umuahia (Southeast Nigeria). Consecutive type 1 or type 2 diabetic patients hospitalized for DFU who gave verbal consent were recruited during the study period. Approval of the study protocol was obtained from the local Research and Ethics committee of each of the hospitals.

Detailed study protocol of the MEDFUN has been published elsewhere.¹⁵ Patients' demographics were collected from admission records obtained on the first day of admission. Other clinical information sought from participants were, duration and type of DM, if ever received foot care education since DM diagnosis, if ever received diabetes care at study centers prior to current admission, past history of DFU, duration of ulcer prior to current admission and history of cigarette smoking.

We sought and documented the presence of co-morbid complications including; shock, hypoglycemia, and anemia. Clinical evidence of wound infection was determined according to the International Working Group on Diabetic Foot (IWGDF) guideline by the presence of purulent exudates or any two or more of the following: peri-wound edema, peri-wound redness, local warmth, foul smell, pain or tenderness on palpation and fever¹⁶. Foot ulceration severity was classified according to Wagner grading of foot ulcers.¹⁷ Peripheral neuropathy was diagnosed by loss of pressure perception to Semmes-Weinstein 10g monofilament test or diminished vibration sense using the 128Hz tuning fork. Peripheral artery disease

(PAD) was diagnosed based on impalpable dorsalis pedis and/or posterior tibial artery pulsations on manual palpation or significant arterial narrowing (>50%) on Doppler ultrasonography of the lower limbs.

Other comorbidities sought and documented included evidence of hyperglycaemic emergency, stroke, hypertension, cardiac failure, and renal impairment which was deemed to be present if serum creatinine was above 1.5 mg/dl or 132micromole/liter.

Laboratory investigations assessed in the participants include glycated haemoglobin(HbA1c), urine protein, serum creatinine, complete blood count, blood culture, ulcer specimen culture, plain radiograph of the foot, lipid parameters which included; total cholesterol(TC), high density lipoprotein cholesterol(HDL-C), low density lipoprotein cholesterol(LDL-C) and triglycerides.

All study subjects were managed based on multidisciplinary care available in all participating centers, and they were followed up for three months after discharge or death while on admission.

We here present the results of the sub-analysis on intrahospital mortality of the MEDFUN study.

Statistical Analysis

Data were analyzed with the Statistical Package for Social Sciences (IBM version 23.0; SPSS Inc., Chicago, IL, USA). Numbers and percentages or means and standard deviations were computed for categorical and continuous variables respectively. Univariate logistic regression was performed for each variable of interest to identify predictors of mortality by calculating their unadjusted odds ratios (ORs) and 95% confidence intervals (CI). All the variables that significantly predicted mortality at this univariate level of analysis were then simultaneously subjected to a stepwise backward multivariate regression, relying on the Hosmer-Lemeshow goodness of fit test for model reliability. Statistical significance was assumed at $P < 0.05$.

Results

Demographic and clinical characteristics

The mean age of the study subjects was 55.9 ± 12.5 years.

The majority (96.1%) had type 2 DM, mean duration of DM was 8.5 ± 5.7 years, 5.1% were current smokers of cigarettes, mean duration of ulcer prior to admission was 39 days with a range of 28 to 54 days. 79.2% presented with at least grade 3 DFU.

The socio-demographic and clinical characteristics of the subjects are summarized in Table 1.

Prognostic outcome

The outcome of 10.4% of the subjects could not be ascertained as they discharged against medical advice (DAMA) for various reasons, topmost of which was for financial constraints. About one-fifth of

those who were hospitalized (and did not discharge against medical advice) died (20.5%).

Figure 1 presents a graphical representation of the outcome of the study subjects.

Mortality rate and Ulcer grade

The highest mortality rate was recorded among subjects who presented with Wagner grade 5 DFU.

Mortality and ulcer grading at presentation is illustrated in figure 2.

Association between clinical variables and mortality

Compared to younger patients below 45 years, middle-aged subjects (age range 45–64 years) had significantly higher mortality with OR 5.107, Confidence interval of 1.429–18.252, and P-value 0.022. Similarly, elderly patients of 65 years and above suffered more mortality in comparison to their younger age counterparts $p = 0.012$.

Other variables significantly associated with mortality with the respective p -values are DM duration more than 120 months (0.008), ulcer duration above one month (0.013), ulcer severity of Wagner grade 3 and above (0.001), peripheral arterial disease (0.002), and foot gangrene (< 0.001).

Laboratory variables that were significantly associated with mortality and their respective p -values

As shown in table 3 laboratory variables significantly associated with mortality include

proteinuria (< 0.001), positive blood cultures (< 0.001), severe vascular stenosis (0.001), moderate vascular stenosis (< 0.001), and Low HDL (< 0.001).

The co-morbid complications that were significantly associated with mortality (Table 4) include; shock at presentation (< 0.001), anaemia (0.034), cardiac failure (0.020), and renal impairment (< 0.001).

Discussion

Diabetic foot ulcers are responsible for considerable morbidity and mortality of diabetic patients. Both hospitalized and patients attending ambulatory care settings who have DFUs are shown in worldwide studies to have higher mortality rates than patients without.^{18, 19} Identification of factors that contribute to or are directly responsible for this high mortality may go a long way in improving survival in patients with DFU.

The intra-hospital mortality rate of 20.5% was recorded in this observational study. This finding is much higher than what was reported previously, both within and outside Nigeria. For instance, Edo et al²⁰ reported a mortality rate of 14 percent in Benin (Southern Nigeria Teaching Hospital). Similarly, Rigato et al in a meta-analysis of studies conducted in many parts of Africa reported a mortality rate of 14%⁹, an Indonesian study observed mortality rate of 10.7%,²¹ while much lower mortality of 4% was reported in

Manchester, England²² and 2% in the United States(US).²³ This observation suggests that DFU-related mortality is not only worrisomely higher in Nigeria than most parts of the world, but that it is also on the increase in Nigeria. Several reasons may account for this observation. First, majority of the patients (72%) enrolled in this study did not access routine diabetes care at the study centers but were referred from primary and secondary health facilities lacking in requisite expertise and facilities. Delay in hospital presentation is another plausible explanation for this observed mortality. For instance, we observed that subjects with ulcer duration longer than one month had more than twice the odds of dying than those with a shorter duration of ulcer. It is an established fact that the longer an ulcer lasts, the higher the likelihood of wound infection that may progress to sepsis. This notion is supported by the fact that sepsis, as evidenced by positive blood culture, remained as an independent predictor of mortality after adjusting for other confounding variables. The much lower mortality in the fore mentioned studies from Manchester and the US may reflect the impact of an advanced healthcare system available in these countries on disease outcomes.

In this study, we found that age was significantly associated with mortality, with the highest mortality recorded among individuals 65 years and above, followed by those in the age range 45 to 64 years. Foryoung et al from Cameroon, Boyco et al from the US, Katze from Israel and Lynar from Australia reported similar findings.^{5, 11, 24, 25} This finding may be explained by the fact that the prevalence of medical comorbidities that may lead to organ dysfunctions and death tend to increase with advancing age. Furthermore, micro and macrovascular diabetes complications are usually more life-threatening when they present in older than younger persons. It has been previously observed that diabetes in older adults is linked to higher mortality, reduced functional status, and increased risk of institutionalization.²⁶ On the contrary, in the fore mentioned Manchester study, age did not have any effect on mortality.²² The observed relationship between age and mortality however disappeared on multivariate analysis, suggesting that the effect of advancing age on DFU-related mortality is indirect, probably through other diabetes complications. This notion is supported by the fact that the presence of some co-morbid complications such as shock, anemia, cardiac failure, and renal impairment were significantly associated with increased mortality in our study.

We observed a proportional increase in mortality with increasing ulcer grade in this study. For instance, subjects with advanced Wagner grade ulcer ($\geq$ grade 3) were almost eight times more likely to die compared to those with lower grade ulcers. This is not surprising since higher Wagner foot ulcer grade indicates more advanced disease and increased probability of sepsis which could predispose the patient to multiorgan dysfunction. Moreover, most DFUs are caused by peripheral neuropathy, and individuals with large fiber neuropathy also have evidence of autonomic neuropathy, which is linked with higher mortality from cardiovascular disease particularly sudden cardiac death.⁴ An earlier Nigerian study also observed increased mortality in patients who presented with Wagner grade 4 and 5 ulcers.⁷ In contrast, Jeraman et al¹⁸ did not find an association between Wagner grade and mortality probably because of a higher percentage of the study subjects presented with Wagner grade 1 and 2 ulcers. It is also noteworthy that the observed association between Wagner grade and mortality in our study was not independent of

other variables as ulcer grade failed to emerge as a significant predictor of mortality when controlled for other potential predictors in multivariate analysis.

In this study, gender was not observed to significantly influence mortality, neither did cigarette smoking status. However, a longer duration of DM was a significant predictor of mortality. A similar finding was also reported by Martins Mendez et al.²⁷ Long duration of DM is associated with the development of micro and macrovascular complications and death.²⁸

We observed that the presence of peripheral arterial disease, as well as foot gangrene, were significant predictors of death. We observed that subjects with PAD had eight times higher probability of death than those without PAD. There was also a significant association between the severity of PAD as detected on vascular imaging and mortality such that subjects with moderate or severe stenosis had significantly higher odds of death compared to those with mild or no stenosis. Peripheral arterial disease in DFUs has been reported to be associated with severe adverse outcomes, which include the lower probability of healing, prolonged healing times, increased incidence of ulcer recurrence, amputations, and higher mortality.^{29,30} Presence of PAD may also be a pointer to atherosclerosis in other vessels including coronary vessels, which place such patients at higher risk of myocardial infarction and sudden cardiac deaths.

Laboratory indices that were predictive of mortality in the cohort of patients in this study include proteinuria, positive blood cultures, and low HDL cholesterol. In an analysis of randomized clinical trials of type 2 DM, selection for renal disease which was defined by either decline in renal function or presence of proteinuria signal important mortality risk.³¹ Furthermore, Aragon-Sanchez et al reported albuminuria, anemia, and leukocytosis as predictors of in-hospital mortality in patients admitted for DFU.³²

Positive blood culture is indicative of sepsis and the attendant systemic inflammatory response which carries a high risk of thromboses and organ dysfunction which have been associated with higher mortality in sufferers both generally and specifically in those with DFUs.^{33,34}

Although diabetic patients with DFU have been observed to have a higher prevalence of cardiovascular risk factors such as hypercholesterolemia, hypertriglyceridemia, hyperuricemia and proteinuria,³⁵ our observation in this study of an association between mortality in hospitalized patients with DFU and low HDL cholesterol appears to be novel. Diabetes mellitus is a cause of low HDL and low HDL has been shown to be a risk factor for cardiovascular disease in the diabetic patient.³⁶ Furthermore, cardiovascular disease is reported to be the most prevalent cause of death in diabetic patients.^{37,38}

Co-morbid conditions that predicted mortality in this study were anemia, hypotension, cardiac failure, and renal impairment. Although we did not elucidate the exact underlying cause for anemia in the study subjects, the possibility of anemia secondary to underlying undetected chronic kidney disease consequent upon diabetic nephropathy could be entertained. Anemia due to nutritional deficiencies could also be a factor. Anemia has been reported to be associated with increased risk for hospitalization and

all-cause mortality.³⁹ The impact of hypotension on mortality is well documented; hypotension promotes inadequate perfusion of vital organs. Sang Wook Yi in a Korean study reported the association between low systolic blood pressure and vascular mortality. Similarly, Tringali described an association between reduction in diastolic blood pressure below 70 millimeters of mercury and all-cause mortality.^{40, 41} We observed that multivariate predictors of mortality were sepsis and renal impairment. The association between mortality and renal impairment may be multifactorial, namely worsening nephrotoxicity from anti biotherapy as well as the underlying cause which in the setting of hospitalization for DFU is sepsis. A recent study from Saudi Arabia reported similar findings of nephropathy being an independent risk factor for all-cause mortality among patients with diabetic foot complications.⁴²

Given the high mortality of hospitalized DFU patients in our setting, identification of the above-stated prognosticators should prompt more intensive management of such DFU patients.

Conclusion

Mortality among Nigerian diabetic patients admitted for DFU is high, univariate predictors of mortality were older age, higher Wagner grade (≥ 3) ulcer, longer duration of DM, longer duration of ulcer before presentation to the hospital, peripheral arterial disease, foot gangrene, renal impairment, low HDL-cholesterol, anemia, shock, and cardiac failure. Renal impairment and positive blood culture were independent determinants of mortality.

Limitations of this study:

The percentage mortality observed in this study may be lower or higher than the actual figures since the outcome in about ten percent (10%) who discharged against medical advice cannot be ascertained. We also did not have uniformity of laboratory test procedures done in the centers, which may affect generalisation of the results.

Abbreviations

DFU: Diabetic foot Ulcers

LEA: Lower extremity amputation

IWDGF: International Working Group on Diabetic Foot

PAD: Peripheral Artery Disease

DM: Diabetes Mellitus

HDL: High density lipoprotein cholesterol

LDL: Low density lipoprotein cholesterol

TG: triglycerides

Declarations

Ethics Approval and Consent to participate

The main approval of the study protocol was obtained from the Ethics committee of the ESUT Teaching Hospital and further approved by the research and ethics committee of each of the participating hospitals/study centers.

Informed verbal consent (approved by the ethics committee) was obtained from all study participants. Confidentiality was ensured at all stages by means of a unique coding system consisting of patients' initials and assigned numbers.

Consent to publish

All study participants agreed to have their data published.

Availability of Data and Materials

Data from this study can be obtained from the corresponding author.

Competing Interests

We do not have any conflicts of interest regarding this publication

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Author Contributions:

All authors contributed significantly at every stage of this study; OOA developed the manuscript and interpreted the data, ETU conceptualized and designed the study protocol, all authors took part in data collection and analysis; IDG, IO, ME and IE critically reviewed the manuscript for intellectual content; all authors read and approved the final manuscript.

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Tables

Table 1. Socio-demographic and clinical characteristics of the subjects

Variable	Overall
Age (years)	55.9 ± 12.5
Gender (male)	185 (55.1%)
Diabetes type (type 2)	323 (96.1%)
Diabetes duration (years)	8.5 ± 5.7
Glycated hemoglobin (%) (n = 296)	9.6 ± 1.9
Receiving diabetes care at the study centers prior to admission	95 (28.3%)
Ever received foot care education since diagnosis of diabetes	87 (25.9%)
Cigarette smoking (current smokers)	17 (5.1)
Duration of ulcer before admission (days)	39 (28-54)
Previous history of ulcer	96 (28.6%)
Presence of wound infection	258 (76.8%)
Ulcer grade (Wagner)	
Grade 1	13 (3.9%)
Grade 2	57 (17.0%)
Grade 3	88 (26.2%)
Grade 4	124 (36.9%)
Grade 5	54 (16.1%)
Co-morbid complications	
Hypertension	191 (56.8%)
Shock	40 (11.9%)
Anemia	180 (53.6%)
Hyperglycemic emergency	123 (36.6%)
Hypoglycemia	33 (9.8%)
Cardiac failure	23 (6.8%)
Renal impairment	66 (19.6%)
Stroke	32 (9.5%)

Table 2. Relationship between demographic and clinical variables and mortality

	Outcome		P-value	OR	95% C.I for OR
	Died n (%)	Survived n (%)			
<i>Age group (years)</i>					
Elderly (≥ 65)	23 (29.5)	55 (70.5)	0.012	5.107	1.429 – 18.252
Middle-aged (45 – 64)	43 (23.8)	138 (76.2)	0.022	4.175	1.230 – 14.177
Young (< 45)	3 (7.1)	39 (92.9)			
<i>Gender</i>					
Male	40 (24.1)	126 (75.9)	0.592	1.160	0.674 – 1.998
Female	29 (21.5)	106 (78.5)			
<i>Cigarette smoking</i>					
Ex	8 (22.2)	28 (77.8)	0.815	0.905	0.392 – 2.091
Current	1 (6.7)	14 (93.3)	0.155	0.226	0.029 – 1.756
Never	60 (24.0)	190 (76.0)			
<i>DM duration (months)</i>					
≤ 120	42 (19.0)	179 (81.0)	0.008	0.461	0.260 – 0.816
>120	27 (33.8)	53 (66.3)			
<i>Ulcer >1 month</i>					
Yes	56 (27.1)	151 (72.9)	0.013	2.311	1.193 – 4.475
No	13 (13.8)	81 (86.2)			
<i>Ulcer grade (Wagner)</i>					
$\geq$ grade 3	66 (27.8)	171 (72.2)	0.001	7.848	2.379 – 25.884
< grade 3	3 (4.7)	61 (95.3)			
<i>Neuropathy</i>					
Yes	52 (22.5)	179 (77.5)	0.757	0.906	0.484 – 1.696
No	17 (24.3)	53 (75.7)			
<i>Peripheral artery disease</i>					
Yes	46 (30.7)	104 (69.3)	0.002	2.462	1.401 – 4.324
No	23 (15.2)	128 (84.8)			
<i>Foot Gangrene</i>					
Yes	59 (37.8)	97 (62.2)	< 0.001	8.211	4.000 – 16.857
No	10 (6.9)	135 (93.1)			
<i>Wound infection</i>					
Yes	58 (25.1)	173 (74.9)	0.105	1.798	0.885 – 3.654
No	11 (15.7)	59 (84.3)			
<i>Previous foot ulcer</i>					
Yes	23 (25.6)	67 (74.4)	0.478	1.231	0.693 – 2.189
No	46 (21.8)	165 (78.2)			
<i>Amputation</i>					
Yes	30 (27.5)	79 (72.5)	0.154	1.490	0.861 – 2.577
No	39 (20.3)	153 (79.7)			

Table 3. Relationship between laboratory indices and mortality

	Outcome		P-value	OR	95% C.I for OR
	Died n (%)	Survived n (%)			
<i>Proteinuria</i>					
Yes	39 (35.8)	70 (64.2)	< 0.001	3.016	1.728 – 5.265
No	29 (15.6)	157 (84.4)			
<i>Glycemic control</i>					
Good	2 (12.5)	14 (87.5)	0.360	2.025	0.447 – 9.174
Poor	57 (22.4)	197 (77.6)			
<i>Blood culture</i>					
Positive	37 (48.1)	40 (51.9)	< 0.001	5.550	2.980 – 10.335
Negative	24 (14.3)	144 (85.7)			
<i>Osteomyelitis</i>					
Yes	20 (24.7)	61 (75.3)	0.417	1.287	0.699 – 2.371
No	41 (20.3)	161 (79.7)			
<i>Vascular Stenosis</i>					
Severe	12 (37.5)	20 (62.5)	0.001	4.414	1.781 – 10.941
Moderate	25 (39.1)	39 (60.9)	< 0.001	4.716	2.226 – 9.993
Mild	15 (20.3)	59 (79.7)	0.123	1.870	0.844 – 4.144
None	14 (12.0)	103 (88.0)			
<i>Total cholesterol</i>					
Elevated	25 (19.5)	103 (80.5)	0.773	0.913	0.491 – 1.698
Normal	25 (21.0)	94 (79.0)			
<i>LDL Cholesterol</i>					
Elevated	29 (21.0)	109 (79.0)	0.734	1.115	0.595 – 2.089
Normal	21 (19.3)	88 (80.7)			
<i>HDL Cholesterol</i>					
Low	54 (33.3)	108 (66.7)	< 0.001	6.714	2.915 – 15.467
Normal	7 (6.9)	94 (93.1)			
<i>Triglycerides</i>					
Elevated	19 (19.6)	78 (80.4)	0.857	0.943	0.498 – 1.785
Normal	31 (20.5)	120 (79.5)			

Table 4. Relationship between co-morbid complications and mortality

	Outcome		P-value	OR	95% C.I for OR
	Died n (%)	Discharged n (%)			
<i>Hypertension</i>					
Yes	42 (23.6)	136 (76.4)	0.739	1.098	0.634 – 1.902
No	27 (22.0)	96 (78.0)			
<i>Shock at presentation</i>					
Yes	19 (50.0)	19 (50.0)	< 0.001	4.260	2.102 – 8.635
No	50 (19.0)	213 (81.0)			
<i>Anemia</i>					
Yes	44 (27.8)	114 (72.2)	0.034	1.822	1.047 – 3.171
No	25 (17.5)	118 (82.5)			
<i>Hyperglycemic emergency</i>					
Yes	30 (27.8)	78 (72.2)	0.135	1.519	0.878 – 2.628
No	39 (20.2)	154 (79.8)			
<i>Hypoglycemia</i>					
Yes	12 (31.6)	26 (68.4)	0.178	1.668	0.792 – 3.511
No	57 (21.7)	206 (78.3)			
<i>Stroke</i>					
Yes	9 (31.0)	20 (69.0)	0.278	1.590	0.688 – 3.673
No	60 (22.1)	212 (77.9)			
<i>Cardiac failure</i>					
Yes	9 (45.0)	11 (55.0)	0.020	3.014	1.194 – 7.608
No	60 (21.4)	221 (78.6)			
<i>Renal impairment</i>					
Yes	29 (48.3)	31 (51.7)	< 0.001	4.677	2.542 – 8.605
No	40 (16.7)	200 (83.3)			

Multivariate regression analysis of all variables reveals sepsis evidenced by positive blood cultures as the strongest predictor of mortality (adjusted OR 5.128; 95% CI 2.614 – 10.060) followed by renal impairment (adjusted OR 2.831; 95% C.I. for OR 1.346 – 5.953)

Table 5 Multivariate Predictors of Mortality

Variable	B	P value	OR	95% C.I.forOR	
				Lower	Upper
Age ≥45	1.220	0.073	3.387	0.890	12.880
Ulcer >1 month duration	0.568	0.157	1.765	0.804	3.877
Peripheral artery disease	0.335	0.355	1.398	0.688	2.840
Positive blood culture	1.635	< 0.001	5.128	2.614	10.060
Anemia	0.037	0.916	1.038	0.522	2.064
Cardiac failure	0.773	0.203	2.166	0.659	7.120
Renal impairment	1.041	0.006	2.831	1.346	5.953

Figures

Figure 1

Pie Chart depicting Prognostic Outcome DAMA = Discharged against medical advice

Figure 2

Mortality rates versus ulcer grades