Research Article

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Prevalence of Diabetes and Pre-Diabetes in Routine Haemoglobin HBA1C Screening and Impacts on Outcomes Among Patients Undergoing Surgery for Trauma

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ABSTRACT

Introduction: *The global prevalence and incidence of diabetes is steadily rising in all populations particularly in low and middle income countries. According to the International Diabetes Foundation, in 2021, an estimated 716,000 adults in Uganda had diabetes and about 89% of Ugandans with diabetes are neither on medication nor aware of their status and therefore present to the health system with difficult to treat complications. In many cases, lack of data is the major barrier for setting up efficient programs for prevention and management of diabetes in diverse populations. Currently, there is a scarcity of data on the prevalence of diabetes among patients that undergo orthopaedic interventions for various disease conditions in Uganda.*

Methods: *We performed a hospital based cross sectional cohort study at Kumi Orthopaedic Center. All individuals who had HBA 1C test done between 2018 to 2024 were included in the study. A self-formulated data abstraction tool was used to extract participants' data from the hospital data base. Patients with HBA 1c levels less than 5.70% were classified as normal, those with levels between 5.70 to 6.49% were classified as pre-diabetic and those with levels greater than 6.50% or currently on diabetes treatment were classified as being diabetic.*

Results: *A total of 1534 participants were included in this study. The majority were female 911(59.4%) while the males constituted 623(40.6%). The mean age of the participants was 55.0 years (SD±15.8) with majority aged between 40 to 59 years (45.6%). The prevalence of diabetes in this study was 17.5% and prediabetes was 25.0% with a general difference between male and females. The prevalence of patients with a history of known diabetes was 14.5% (39) among those categorized as diabetic according to levels of HbA1c. Having elevated systolic blood pressure was a statistically significant predictor for diabetes (OR 1.60 95% CI 1.14-2.34: P=0.007). There was a higher infection rate noted among patients with diabetes (5%) compared to those without diabetes (2.1%) following surgery for trauma.*

Conclusion: *The prevalence of diabetes and pre-diabetes is high among patients seen at Kumi Orthopaedic Center and remains undiagnosed in an alarmingly high proportion of individuals. These findings high light the need for continuous monitoring/screening for diabetes among patients seeking orthopaedic care. There is also a need for large scale studies to accurately quantify the burden and identify effective interventions and treatment strategies across diverse hospital populations.*

Keywords
Diabetes, Orthopedic, Haemoglobin, Surgery.

Introduction
The global prevalence and incidence of diabetes is steadily rising in all populations [1]. The International Diabetes Foundation, in 2021, estimated that 716,000 adults in Uganda had diabetes and about 89% of Ugandans with diabetes are neither on medication nor aware of their status and therefore present to the health system with difficult to treat complications [2]. There has been an

increasing number of orthopaedic operations carried out in older populations in whom the prevalence of diabetes is dramatically increasing [3,4]. Diabetes is associated with high complication rates as a result of increased risk of surgical site infection, non-union, malunion, hardware failure, neuropathic ulcers, prolonged hospital stay, impaired healing of soft tissues all of which can lead to poor functional outcomes in the long run [5].

Kumi Orthopaedic Center carries out orthopaedic surgeries for trauma on a number of diabetic patients in whom pre-operative glycemic control is difficult to achieve given that in trauma, operative treatment is difficult to delay limiting the duration for sufficient pre-operative glycemic control. This leads to increased risk of negative surgical outcomes as a result of increased incidence of post-surgical complications [6]. This poses a risk for poor quality of life and high financial burden on patients and the state at large. However, in Uganda there is limited data on the current treatment outcomes for patients with diabetes following orthopaedic surgery for trauma especially in rural settings. There is therefore a need to ascertain the current treatment outcomes in this population.

Methods

This was a cross sectional cohort study of patients who had routine HbA1c test for diabetes and had surgery for trauma at Kumi-Orthopaedic Center between 2018 and 2024. Patients with HbA1c levels greater than 6.5% and those with known diabetes were considered to be diabetic, levels of HbA1c between 5.7%-6.49% were pre-diabetic and those with levels less than 5.7% were considered normal. These were followed up to assess treatment outcomes following surgery. Patients with evidence of osteomyelitis or infection at admission (baseline) were excluded from the study.

Data was retrieved from the hospital data base using a self-formulated data abstraction tool. This included the patients' age, sex, blood pressure, HbA 1c level and history on whether a patient was a known diabetic or not. Data was entered into excel and analyzed using Stata version 17.0.

Results

A total of 1534 participants were included in this study. The majority were female 911(59.4%) while the males constituted 623(40.6%). The mean age of the participants was 55.0 years (SD±15.8) most of whom were 60 years and above (34.8%). The prevalence of diabetes and prediabetes in this study was 17.5% and 25.0% respectively with a general difference between male and females. The prevalence was highest in patients aged between 51 to 60 years (23.4%) followed by those above 60 years (21.5%). The prevalence of patients with a history of known diabetes was only 14.5%(39) among those categorized as diabetic (HbA1c >6.5) (Table 1).

In univariate logistic regression analysis, Age (OR 1.02 per 1 year, 95%CI 1.01-1.03: P <0.001), Elevated systolic blood pressure grater than 140mmHg (OR 1.70, 95%CI 1.23-2.37: P=0.002), Elevated diastolic pressure greater than 90mmHg (OR 1.46, 95% CI 1.06-2.00: P=0.020) were statistically significant predictors for Diabetes. (Table 2). However, at multivariate logistic regression only having elevated systolic blood pressure was significant predictor for diabetes (OR 1.60, 95%CI 1.14-2.34: P =0.007).

Following surgery for trauma, there was a higher infection rate noted among patients with diabetes (5%) compared to those without diabetes (2.1%).

Table 1: Socio-demographic and clinical characteristics of the 1534 participants.

Parameter	Frequency n(%)
Age (mean, SD)	55.0(±15.8)
Sex	
Female	911(59.4)
Male	623(40.6)
HbA1c	
Normal	882(57.5)
Pre-diabetic	384(25.0)
Diabetic	268(17.5)
Among Diabetic	
Known diabetic	39(14.5)
Unknown diabetic	229(85.8
Systolic Blood pressure	
Less than 140mmHg	543(45.5)
Greater than 140mmHG	651(54.5)
Diastolic Blood pressure	
Less than 90mmHg	620(51.9)
Greater than 90mmHg	574(48.1)

Table 2: Predictors for Diabetes among the 1534 participants.

Variable	Category	cOR (95%CI)	P-value
Age		1.02(1.01-1.03	<0.001
Systolic blood pressure	Less than 140mmHg	Ref	
	Greater than 140mmHg	1.70 (1.23-2.37)	0.002
Diastolic blood pressure	Less than 90mmHG	Ref	
	Greater than 90mmHg	1.46(1.06-2.00)	0.020

Discussion

This is one of the first studies documenting the prevalence of diabetes in Orthopaedics in Uganda. The prevalence of diabetes was 17.5% and prediabetes was 25.0%. This is higher than the diabetes and prediabetes prevalence of 16.98% and 10.91% respectively found in a Pakistan community wide survey of 18856 participants. However, both studies found the highest prevalence to be in participants between 51-60 years [7]. A study carried out in Tanzania on 992 people using HbA1c results reported a similar prevalence of pre diabetes of 25%. However, the prevalence of diabetes was lower (6.8%) [8]. In Barbados, a similar study reported a higher prevalence of prediabetes (41.7%) [9]. The difference in the prevalence of diabetes and prediabetes across these studies could be attributed to difference in study populations e.g. the study at KOC looked at hospital participants only while the studies in Pakistan and Tanzania were community surveys.

Conversely, a study on 3733 hospitalized adult patients in Germany found a higher prevalence of diabetes of 22.15% (HbA1c>6.5%) but a similar prevalence of prediabetes of 23.68% (HbA1c 5.7%-6.49%) without a history of previous diabetes [10]. It also found that the prevalence of hospital acquired complications was higher in diabetic patients.

In Uganda, a study in Kanungu found that most affected age group to be those between the ages of 61-65 years [11] which is not very different from the findings in our study. Generally, the projections for the increase of diabetes prevalence are most dramatic for developing countries and particularly sub-Saharan Africa as a consequence of the fast demographic and epidemiological transition [12-14].

Elevated systolic blood pressure was significantly associated with increased risk of incident diabetes. This is similar to findings by a study carried out among 4899 people in a community based prospective study in Korea [15]. This could be explained by the fact that hypertension and diabetes substantially share common pathways such as obesity, oxidative stress, insulin resistance and mental stress.

Following surgery for trauma, there was a higher infection rate noted among patients with diabetes (5%) compared to those without diabetes (2. 1%). This is similar to findings in a systematic review that showed that patients with type 2 diabetes are at an increased risk of developing SSIs post orthopaedic surgery compared to non-diabetic individuals (OR=1.63; 95%CI :1.19-2.22) [16]. A systematic review and meta-analysis of 94 studies by Martin et al. in 2016 also found that diabetes had a higher risk of infections (OR 1.53; 95% CI: 1.11-2.22). This is explained by the fact that diabetes has been found to be an independent risk factor for SSIs for multiple surgical procedure types in general [17]. This increased risk is attributed to factors like impaired wound healing, weakened immune function and the impact of hyperglycemia on infection control. This therefore calls for adequate glycemic control for patients undergoing any surgical procedure.

This study was subject to some limitations. The fact that it was a retrospective study and therefore most likely to be affected by limited and missing data. The prevalence of diabetes might have been over estimated due to a single point HbA1c measurement [18]. The data does not allow drawing of definitive conclusions about the progression of pre-diabetes to diabetes.

Conclusion

The prevalence of diabetes and pre-diabetes is high among patients seen as Kumi Orthopaedic Center and remains undiagnosed in an alarmingly high proportion of individuals. These findings high light the need for continuous monitoring/screening for diabetes among patients seeking orthopaedic care. There is also a need for large scale studies to accurately quantify the burden and identify effective interventions and treatment strategies across diverse hospital populations.

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