

Hypoglycemia in Diabetics 65 Years and Older Using Ademolus Classification of Hypoglycemia

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Abstract

Introduction: Aging is one of the well-recognized risk factor of diabetes mellitus recognized worldwide in literature. Aging at the molecular and cellular level is characterized by the occurrence and accumulation of damage in DNA and RNA protein. This research seeks to answer the question what clinical deduction can be derived from the management of diabetics 65 years and above in African when Ademolus Classification of Hypoglycemia (ACH) is used as a tool in this age bracket?

Methodology: This is a retrospective study of 182 documented hypoglycemic episodes occurring in 64 diabetics attending the Lagos State University Teaching Hospital Ikeja in Africa between September 2004 and November 2017, a 13 years period. Exclusion criteria include probable hypoglycemia, hypoglycemia occurring in non-diabetics, hypoglycemia in diabetics aged below 65 years were also excluded from the study. Hypoglycemia was defined as blood sugar of 70mg/dl or less whether symptomatic or not.

Result: In all, 182 episodes of hypoglycemia were analyzed. 97 episodes from the 22 in patients involved in this study and 85 hypoglycemic episodes from 42 out patients involved in this study.

Discussion: The tendency for elderly diabetic patients 65 years and above to develop hypoglycemia is more with in patient or hospitalized patient management when blood sugar control is intensive compared with outpatient management. Also, from this study, it can be deducted that if diabetics 65 years and older is having life threatening problem with repeated severe hypoglycemia while on insulin or insulin and oral hypoglycemic agents then consider placing them on oral hypoglycemic agents alone

Conclusion: The tendency for elderly diabetic patients 65 years and above to develop hypoglycemia is more with in patient or hospitalized patient.

Keywords: Hypoglycemia; Ademolus classification of hypoglycemia; Elderly; Insulin; Oral hypoglycemic agents.

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Received Date: 03-25-2022

Accepted Date: 04-20-2022

Published Date: 04-30-2022

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Introduction

Aging is one of the well-recognized risk factor of diabetes mellitus recognized worldwide in literature [1,2]. Aging at the molecular and cellular level is characterized by the occurrence and accumulation of damage in DNA and RNA protein [3]. Pancreas undergoes various pathological changes with aging characterized by increased fatty replacement, fibrosis, lymphoplasmacytic infiltration, amyloid deposition, a decreased weight [4]. Aging forms different proportion of national population across Africa and the world over [5,6]. However, hypoglycemia has not been adequately studied in geriatric patients in African diabetic patients compared to other parts of the world like the United States and Canada [7-11].

This research seeks to answer the question what clinical deduction can be derived from the management of diabetics 65 years and above in African when Ademolus Classification of Hypoglycemia (ACH) is used as a tool in this age bracket?

Methodology

This is a retrospective study of 182 documented hypoglycemic episodes occurring in 64 diabetics attending the Lagos State University Teaching Hospital Ikeja in Africa between September 2004 and November 2017, a 13 years period. Both symptomatic and asymptomatic hypoglycemia documented in the case-note of randomly selected diabetic subjects were thoroughly studied and included. Exclusion criteria include probable hypoglycemia, hypoglycemia occurring in non-diabetics, hypoglycemia in diabetics aged below 65

years were also excluded from the study. Hypoglycemia was defined as blood sugar of 70mg/dl or less whether symptomatic or not. Both out and inpatient diabetes management complicated by hypoglycemia were studied. All cases studied were type 2 diabetic patient as none of the retrieved case note is that of type 1 diabetic patients.

A pretested and validated questionnaire was drawn and administered as a tool to extract relevant information from each of the relevant 50 case files of these admitted African with diabetes mellitus. The questionnaire is in two sections. Section A retrieved demographic data from the case file excluding names. Section B retrieves divers' information on each hypoglycemic episode including absolute value of hypoglycemia in mg/dl, date of occurrence, time of occurrence, type of diabetes mellitus patient is being managed for, clinical features at time of occurrence (if documented) drug patient is on, insulin or glucose lowering agents or both, comorbidity amongst other questions.

Results

In all, 182 episodes of hypoglycemia were analyzed. 97 episodes from the 22 in patients involved in this study and 85 hypoglycemic episodes from 42 out patients involved in this study. Of all the 182 hypoglycemic episodes, 126 hypoglycemic episodes occurred as grade 1 representing 69.23%. Grade 2 hypoglycemic episodes formed a total 41 hypoglycemic episodes representing 22.53% while grade 3 accounted for 15 hypoglycemic episodes representing 8.24% as shown in Figure 1.

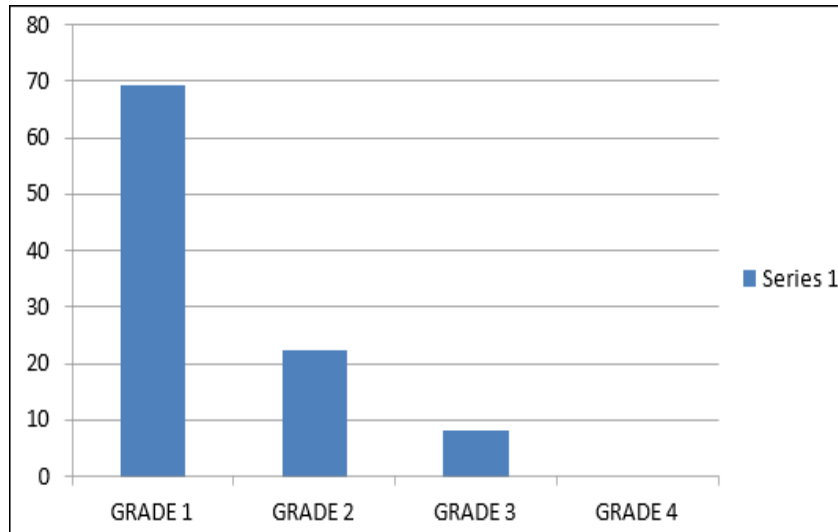


Figure 1: Percentage distribution of Hypoglycemic episodes in elderly diabetics 65 years and above on glucose lowering agents using Ademolus classification of hypoglycemia (ACH) (N=182).

Among the 97 hypoglycemic episodes in in patients, there were 52 hypoglycemic episodes occurring as grade 1 hypoglycemia this represent 53.61%, Grade 2 were 30

hypoglycemic episodes representing 30.93% while grade 3 were 15 hypoglycemic episodes representing 15.46% as shown in Figure 2.

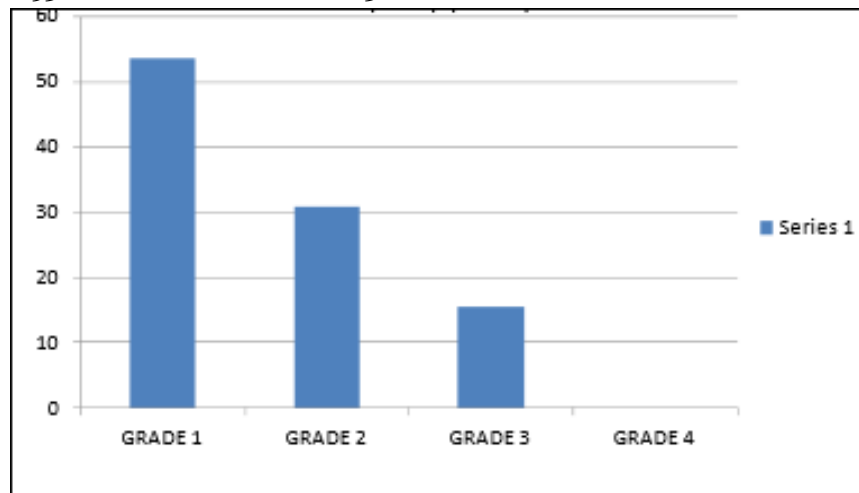


Figure 2: Percentage distribution of Hypoglycemic episodes in hospitalized elderly diabetic 65 years and older using Ademolus classification of Hypoglycemia (ACH) (N=97).

Among the 85 hypoglycemic episodes in out-patients in this study, 74 episodes were grade 1 representing 87.06% while 11 hypoglycemic

episodes were grade 2 representing 12.94%. There were no grade 3 hypoglycemia recorded in out-patient in this study as shown in Figure 3.

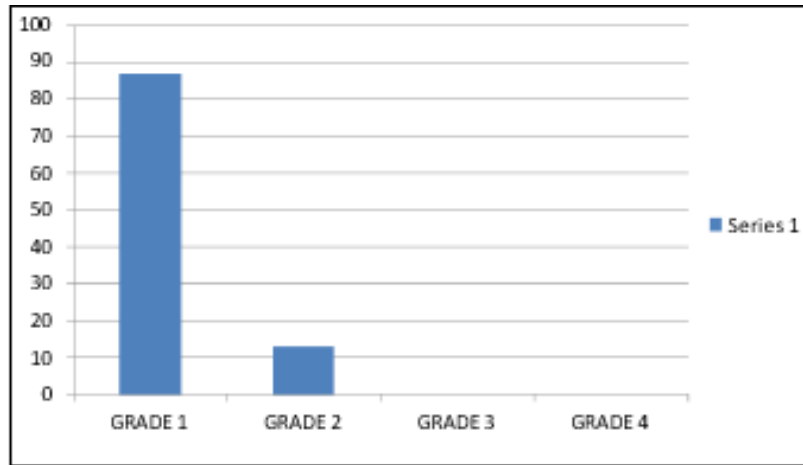


Figure 3: Percentage distribution of Hypoglycemic episodes in out-patients elderly diabetics 65 years and older using Ademolus classification of Hypoglycemia (ACH) (N=85).

With respect to decades of life among in patients. There was a total of 34 hypoglycemic episodes in 7th decade of life. Grade 1

accounted for 15 episodes representing 44.12%, grade 2 were 12 episodes representing 35.29%, while grade 3 were 7 episodes representing 20.59% as shown in Figure 4.

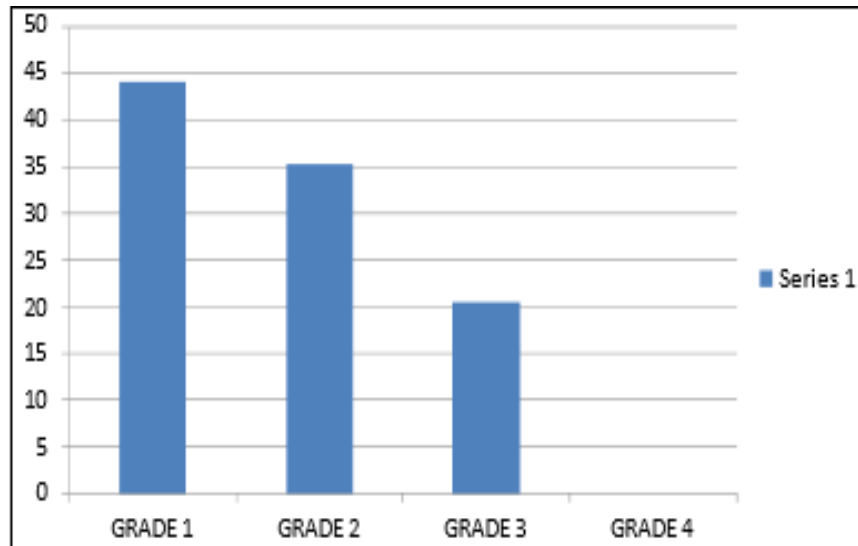


Figure 4: Percentage of Hypoglycemic episodes in 7th decades of life in hospitalized elderly diabetic Ademolus classification of Hypoglycemia (ACH) (N=34).

In the 8th decades of life, there were 56 hypoglycemic episodes in all, grade 1 were 35 episodes representing 62.5%. Grade 2 were 14

episodes representing 25% while grade 3 were 7 hypoglycemic episodes representing 12.5% as shown in Figure 5.

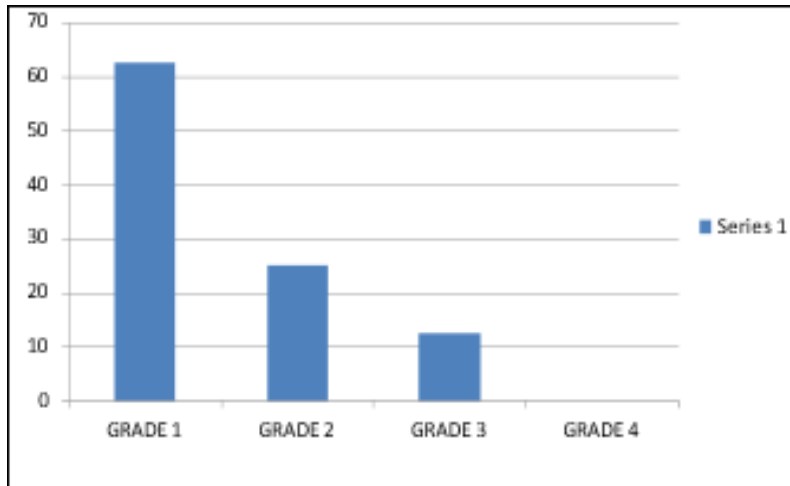


Figure 5: Percentage distribution of Hypoglycemic episodes in 8th decades of life in hospitalized elderly diabetics using Ademolus classification of Hypoglycemia (ACH) (N=56).

In the 9th decades of life in in patients, only two hypoglycemic episodes were recorded. one grade 2 hypoglycemic episode and one grade 3 hypoglycemic episode. In the 10th decades of life, there were 5 hypoglycemic episodes recorded. Grade 1 were 2 hypoglycemic episodes representing

40% while 3 were grade 2 hypoglycemic episodes representing 60%. The distribution however is different in out-patients. In the 7th decades of life, grade 1 were 23 out of 26 hypoglycemic episodes recorded representing 88.46% while the remaining 3 hypoglycemic episodes were grade 2 representing 11.54% as shown in Figure 6.

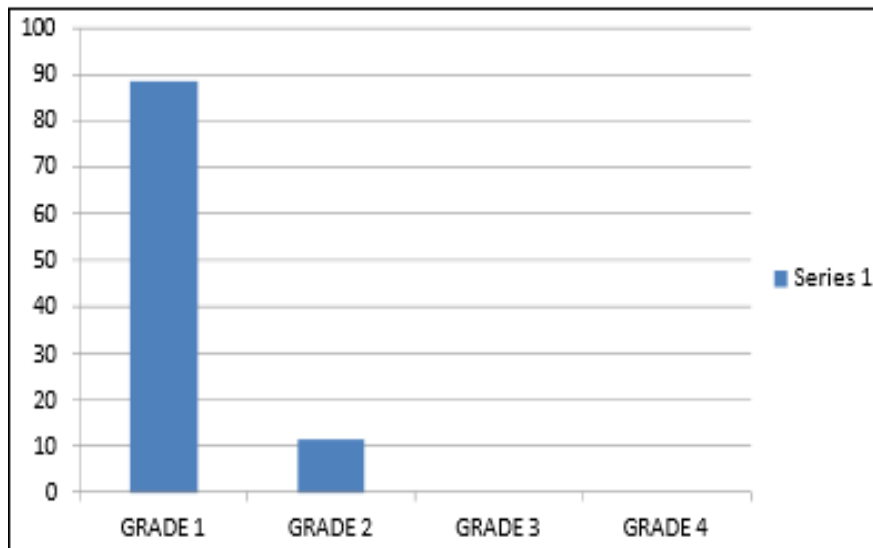


Figure 6: Percentage distribution of Hypoglycemic episodes in 7th decades of life in out-patients elderly diabetic 65 years and older using Ademolus classification of Hypoglycemia (ACH) (N=26).

In the 8th decades of life, out of the 28 hypoglycemic episodes recorded, grade 1 hypoglycemic episodes were 24 representing

85.71%, grade 2 were 4 episodes representing 14.29% as shown in Figure 7.

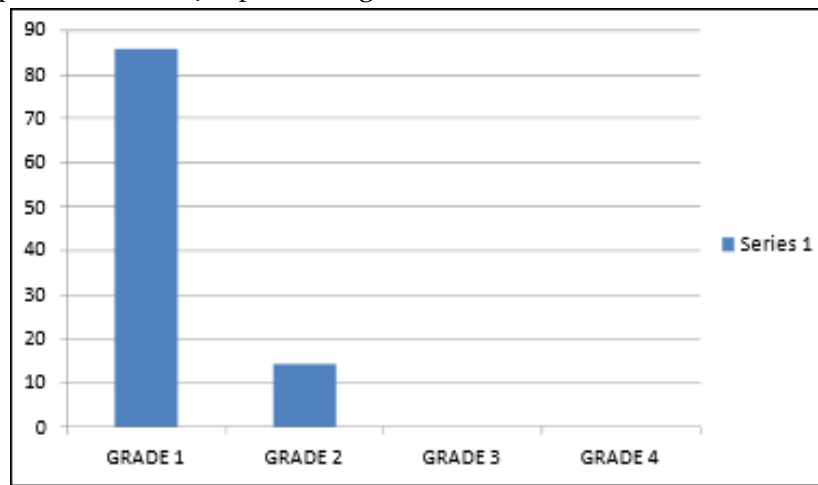


Figure 7: Percentage distribution of Hypoglycemic episodes in 8th decades of life in out-patients elderly diabetic using Ademolus classification of Hypoglycemia (ACH) (N=28).

In the 9th decades of life, 31 hypoglycemic episodes were recorded, grade 1 were 27 hypoglycemic episodes representing 87.1%,

while grade 2 were 4 episodes representing 12.9% as shown in Figure 8.

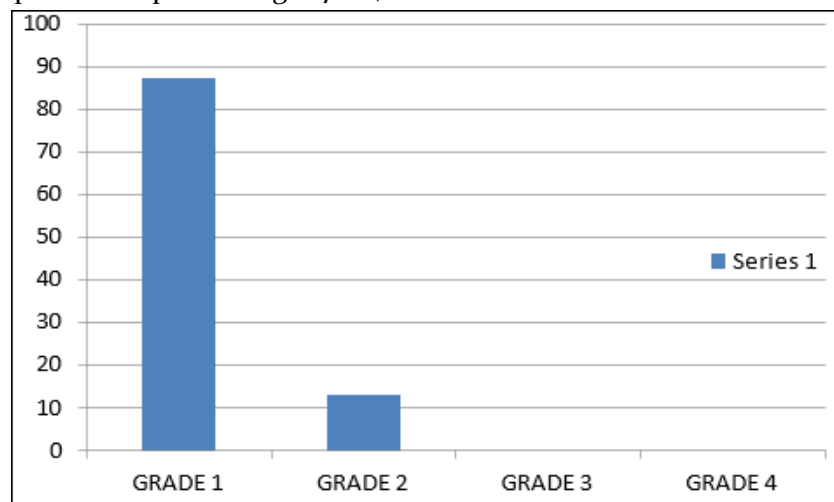


Figure 8: Percentage distribution of Hypoglycemic episodes in 9th decades of life in out-patient elderly diabetics using Ademolus classification of Hypoglycemia (ACH) (N=31).

Concerning glucose lowering agent use, that is insulin alone, oral hypoglycemic agent alone and combining insulin and oral hypoglycemic agent, in relation to all hypoglycemic episodes recorded in this study,

a total of 126 hypoglycemic episodes were recorded as grade 1 representing 69.23%, grade 2 were 41 episodes representing 22.53% while grade 3 were 15 episodes representing 8.24%. In patients, a total of 80 hypoglycemic

episodes were recorded by in patients on insulin therapy alone. Grade 1 hypoglycemia were 45 episodes representing 56.25%, grade 2 were 24 hypoglycemic episodes

representing 30%, grade 3 were 11 hypoglycemic episodes representing 13.75% as shown in Figure 9.

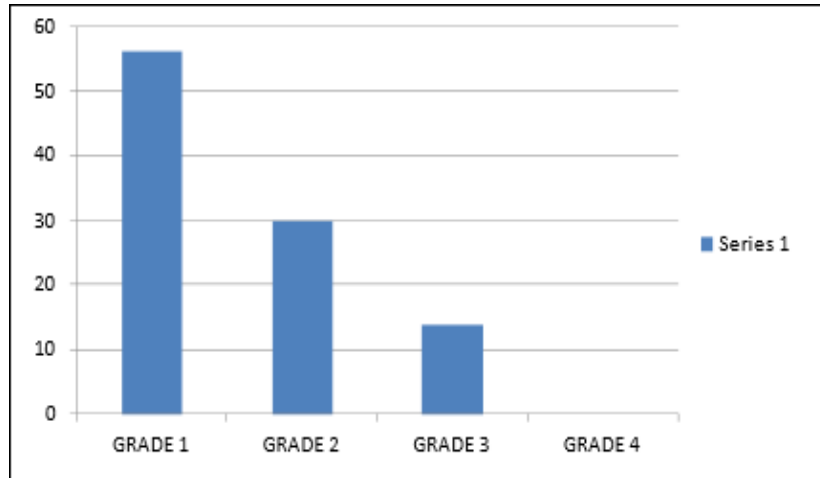


Figure 9: Percentage distribution of Hypoglycemic episodes in hospitalized elderly diabetic 65 years and above on insulin alone using Ademolu classification of Hypoglycemia (ACH) (N=80).

Only 3 hypoglycemic episodes were recorded among in patients on oral hypoglycemic agents alone, one episode was grade 1 representing 33.3% while the remaining 2 hypoglycemic episodes were grade 2 representing 66.6%. In elderly diabetics on insulin combined with oral hypoglycemic

agents in this study, a total of 14 hypoglycemic episodes were formed. Grade 1 were 6 episodes representing 42.86%, grade 2 were 4 episodes representing 28.57% while grade 3 were equally 4 hypoglycemic episodes representing 28.57% as shown in Figure 10.

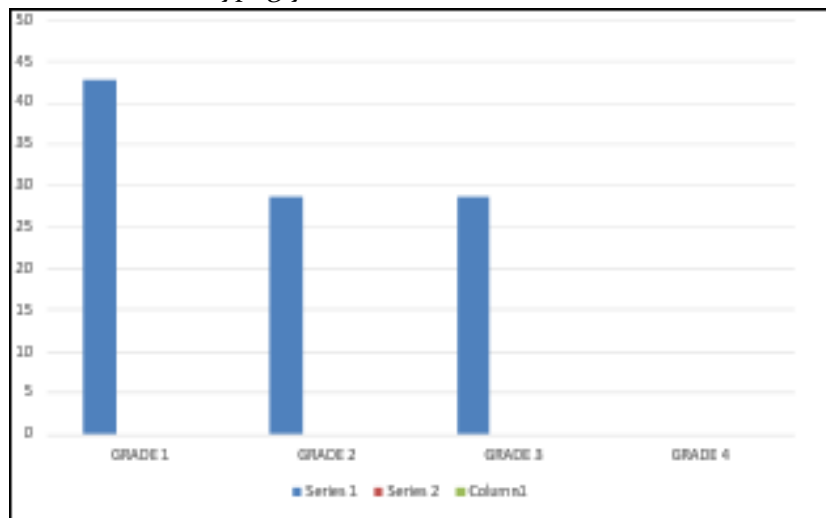


Figure 10: Percentage distribution of Hypoglycemic episodes in Elderly diabetics 65 years and above insulin and oral Hypoglycemic agents using Ademolus classification of Hypoglycemia (N=14).

Among the out patients, only 5 episodes of hypoglycemia were recorded in out-patients on insulin alone in this study. 4 of these episodes were grade 1 representing 80% while one is grade 2 representing 20%. The majority of the elderly out-patients hypoglycemic

episodes occur in the category of those on oral hypoglycemic agents alone in this study with 79 episodes, of these grades 1 were 69 episodes representing 87.34% while grade 2 were 10 episodes representing 12.66% as shown in Figure 11.

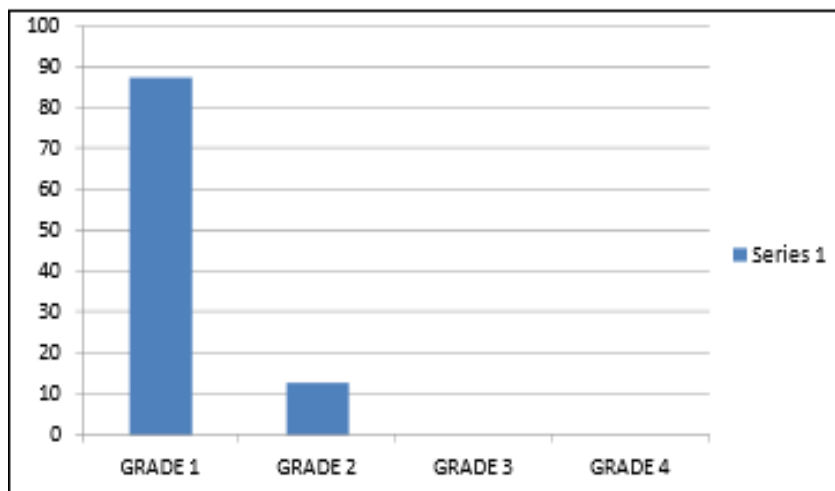


Figure 11: Percentage distribution of Hypoglycemic episodes in out-patient elderly diabetics 65 years and above on oral Hypoglycemic agents alone using Ademolus classification of Hypoglycemia (ACH) (N=79).

Only one episode of hypoglycemia was recorded in the category of elderly placed on insulin and oral hypoglycemic agent and it was a grade 1 hypoglycemic episode.

Discussion

The tendency for elderly diabetic patients 65 years and above to develop hypoglycemia is more with in patient or hospitalized patient management when blood sugar control is intensive compared with outpatient management [12-15]. Hence clinicians need to be less aggressive on blood sugar control in diabetes mellitus patients 65 years and older on admission because the risk of severe hypoglycemia is more than when they are on out patient's management [16-18]. In fact, in this study on elderly African diabetes mellitus patient, there were no grade 3 hypoglycemia

or severe hypoglycemia recorded in the outpatient whereas in the hospitalized patient 15.46% had severe hypoglycemia.

More hypoglycemic episodes occurred with elderly diabetics on insulin alone [19]. Compared to those on oral hypoglycemic agents alone aside, mild, moderate and severe hypoglycemia were noticed with elderly diabetics on insulin alone while mild and moderate hypoglycemia were noticed on elderly diabetic on oral hypoglycemic agent. Some reasons may be adduced to this, first the patient on oral hypoglycemic agent have had first pass effect which lowers the blood concentration of oral hypoglycemic agent. Whereas insulin does not undergo first pass effect, since it is an amino acid that can be digested if taken orally [20,21].

In some instances, insulin is even given intravenously making its bioavailability to be 100%, hence since there is enough insulin concentration in serum this possibly explain why tendency to form different grades of hypoglycemia including severe hypoglycemia is comparatively higher [22]. Aside the fact that insulin metabolism is reduced in patients with diabetic nephropathy is another reason that can explain why these elderly patients had grades 1,2 and 3 hypoglycemia since the decreased insulin metabolism will predispose to prolonged plasma concentration of insulin and hence increased anabolic effect of glucose entering peripheral tissue and thereby lowering plasma glucose. Long standing diabetes mellitus which is usual in elderly diabetics is a possible risk factor for developing diabetic nephropathy in them whether diagnosed or not [23].

Also, from this study, it can be deduced that if diabetics 65 years and older is having life threatening problem with repeated severe hypoglycemia while on insulin or insulin and oral hypoglycemic agents [24]. Then consider placing them on oral hypoglycemic agents alone as this reduces the risk of hypoglycemia from moderate to mild based on this study, even severe hypoglycemia was not recorded in this study with oral hypoglycemic agents, though this does not mean it cannot occur as this may depend on comorbidities and class of oral hypoglycemic agent [25].

Furthermore, from this study, if African diabetic 65 years and older are on both insulin and oral hypoglycemic agents, risk of developing moderate to severe hypoglycemia is more than if they are on insulin therapy alone based on this study.

Ademolu classification of Hypoglycemia and nocturnal Hypoglycemia

In this study, a number of the elderly diabetic had nocturnal hypoglycemia, their nocturnal hypoglycemia were in the form of grades 1,2 and 3 hypoglycemia [26-28].

A 73 years old male type 2 diabetic had nocturnal hypoglycemia of 60mg/dl which is grade 1 hypoglycemia. A 69 years old man with bilateral above knee amputation and on subcutaneous glargine 6iu and tab metformin 500mg bd had nocturnal hypoglycemia at a value of 36mg/dl which is grade 3 hypoglycemia. A 66 years old man had two episodes of nocturnal hypoglycemia, one episode occurring as grades 2 and the other episode occurring as grade 3 hypoglycemia.

These three cases showed that nocturnal hypoglycemia can be mild, moderate and severe form of hypoglycemia occurring in the night. Grade 4 hypoglycemia was not recorded as nocturnal hypoglycemia in this study, but that did not mean nocturnal hypoglycemia occurring as grade 4 hypoglycemia does not exist in elderly diabetics. Nocturnal hypoglycemia grade 4 may be associated with a very high mortality in elderly diabetics that does not reach the hospital before their demise or possibly such patients may be found dead in bed overnight from metabolic derangement or metabolic coma.

The fact that nocturnal hypoglycemia can be mild, moderate or severe form of hypoglycemia emphasize the need for elderly type 2 diabetics to have corrective measures/drugs (e.g. glucose drink, glucagon) in place or at hand even at night in

case they develop nocturnal hypoglycemia at grade 3 hypoglycemia level! Or if they develop nocturnal hypoglycemia at any distressing level since in literature it has been demonstrated that hypoglycemia can be symptomatic at any of grades 1 to 4 [29].

Miscellaneous cases

In this study there were other findings like a 70 years old lady newly diagnosed with type 2 diabetes with grade 2 hypoglycemia managed for hypertension and cerebrovascular accident she was on soluble insulin. There were two elderly diabetics with chronic/recurrent hypoglycemia lasting for three consecutive months. One a 70 years old man had a Ademolus Hypoglycemic index (AHI) of 0.54 while the other a 66 years old man also had an AHI of 0.54.

There was a 79 years old lady with type 2 diabetes and cerebrovascular accident with upper gastrointestinal bleeding, severe anemia and hypoglycemia who later died with cause of death unrelated to hypoglycemia, she was on soluble insulin, and had rebound hypoglycemia. There is a need to research into what the frequency of rebound hypoglycemia is in elderly diabetics 65 years and above compared to type 2 diabetes mellitus population in general.

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Conclusion

Clinical deduction can be derived by using Ademolus Classification of Hypoglycemia in elderly 65 years and older. It shows that the tendency for elderly diabetic patients 65 years and above to develop hypoglycemia is more with in patient or hospitalized patient management when blood sugar control is intensive compared with out-patient management. More hypoglycemic episodes occurred with elderly diabetics on insulin alone compared to those on oral hypoglycemic agents alone. If diabetics 65 years and older is having life threatening problem with repeated severe hypoglycemia while on insulin or insulin and oral hypoglycemic agents then consider placing them on oral hypoglycemic agents alone as this reduces the risk of hypoglycemia.

Disclosure

Nothing to disclose.

Funding

This project was not funded by any government or non-governmental organization. It is self-funded.

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