

Frequency of in-Patients Hyperglycemia in a medical ward of a Tertiary Care Hospital at Lahore

MUHAMMAD NAEEM AFZAL¹, BILAL MAHMOOD², USMAN KHALID², SALEHA ASGHAR², BILAL HAMEED², RABIA ANJUM², MUHAMMAD NAEEM SAFDAR CHAP², IRSHAD HUSSAIN QURESHI³, KASHIF SIDDIQUE⁴

ABSTRACT:

Background: Hyperglycemia (diabetes or stress-hyperglycemia) is quite frequent in hospital setting, and is of prognostic importance. No study in Pakistan has so far looked into frequency of hyperglycemia in medical in-patients.

Aim: To find out the frequency of known diabetics, and hyperglycemia in all patients admitted in medical unit and to find out the frequency of hyperglycemia in various disease categories.

Methods: A retrospective chart review was done of patients admitted from Oct 2012 to Sep 2013 in a medical unit of department of Internal Medicine, King Edward Medical University Lahore. "Known diabetics" were evident from history or medical record. "To be treated hyperglycemia" was defined as having blood sugar level ≥ 180 mg/dl, "Hyperglycemia to be investigated for occult diabetes" was defined as having blood sugar level ≥ 140 mg/dl and "Possible undiagnosed diabetes" was defined as having blood sugar level ≥ 200 mg/dl.

Results: Among total of 1889 participants in our study, 949 were male, and 940 were female. Mean age of study population was 49 ± 19.6 years. Overall, 24.3% (459) of admitted patients were (19.5% of males and 29.1% of females) were known diabetics. Among those not known to be diabetic (n=1430), 430(30%) had readings ≥ 200 mg/dl. Almost 53% had blood sugar ≥ 140 mg/dl during their hospital admission. Overall frequency of to-be treated hyperglycemia (≥ 180 mg/dl) was 48%. Very high blood sugar ≥ 350 mg/dl was found in 13.7% of all hospital admissions. Mean blood sugar of the study population was 210 ± 117 mg/dl, that of known diabetics was 313 ± 125 mg/dl, while it was 177 ± 94 mg/dl in others. Patients with septicemia, renal, liver, cardiac diseases, and stroke had a high toll of hyperglycemia.

Conclusion: Almost 1/4th of our medical admissions are diagnosed diabetics while another third are potentially undiagnosed diabetics. Almost half of the patients are candidate for treatment of hyperglycemia in medical ward.

Keywords: In-patient hyperglycemia, diabetes, blood sugar levels

INTRODUCTION

Diabetes is a serious lifelong disease with known short term and long term complications. Patients admitted in ward have worsened glycemic control due to multiple factors like increased insulin resistance due to stress of illness, diet and drugs. This increased insulin resistance also unmasks hidden diabetes as well as shows transient stress related hyperglycemia. In either case, hyperglycemia during the illness has its documented negative effect on disease outcome¹. That's why many statutory bodies in diabetes research like ADA, AACE, Endocrine Society & Diabetes-UK advise routine checking of blood sugar in each admitted patient and

suggests different measures to control hyperglycemia. It is generally advised that during hospital stay, patients with blood sugar ≥ 180 mg/dl should be treated with designated protocols to improve the outcome, and those blood sugar ≥ 140 mg/dl should be investigated for occult diabetes or stress related hyperglycemia^{2,3,4}. Internationally, a lot of epidemiology data are available depicting a range of diagnosed and undiagnosed diabetics in hospitalized patients^{5,6,7,8}. In Pakistan, two small studies pointed out high frequency of known diabetics (31.6%) and newly diagnosed diabetics (29.6%) in patients of acute myocardial infarction^{9,10}. Two local studies in ischemic stroke patients^{9,10} and one from pediatric ICU also showed worse outcome with in-hospital hyperglycemia¹¹. However, local data totally lacks the overall frequency of hyperglycemia in medical ward. We planned this study to document burden of disease in medical in-patients.

¹Assistant Professor Internal Medicine, K.E. Medical University, Lahore

²PGR Internal Medicine, K. E. Medical University, Lahore

³Chairman/Professor, Department of Internal Medicine, King Edward Medical University, Lahore

⁴Biostatistician, PGMI/ Gulab Devi Hospital, Lahore

Correspondence to Dr. Muhammad Naeem Afzal, Assistant Professor, Email: dr_mna1@yahoo.com

MATERIALS AND METHODS

We conducted a study in Medical Unit III at Mayo hospital, Lahore. This was a retrospective study with chart review of 1889 patients admitted in male and female medical ward through emergency and outpatient department from Oct 2012 to September 2013. The objective of study was to determine frequency of diagnosed diabetics, possible undiagnosed diabetics, and frequency of hyperglycemia in hospitalized patients in medical ward. The operational definitions were, to-be treated hyperglycemia (≥ 180 mg/dl), to be investigated hyperglycemia (≥ 140 mg/dl), and possible undiagnosed diabetes (≥ 200 mg/dl). The first two operational definitions were derived from Endocrine Society guidelines², while third was adopted from conventional definition as adopted by studies from different countries^{5,6,7,8}. Throughout the study period, blood sugar was measured by Optium Xceed glucometer by Abbott diagnostics diabetes care. As per ward routine, blood sugar values on glucometer were frequently counterchecked and compared with simultaneous lab values. Different variables like age, gender, known diagnosis of diabetes, highest blood sugar recorded during hospital stay, and final diagnosis, were recorded. Known status of diabetes was assessed by history from patients or family and/or by review of medical record or list of medications patient was taking. Patient was labeled diabetic only once either of these criteria confirmed it. Data were entered in SPSS 20.0 version. Frequencies were calculated and reported in percentage. Patients having diseases of similar percent (e.g. cardiac) were grouped under the heading of that system only for purpose of cross-tab analysis. Cross-tabulation of different glycemic cut-off was done according to gender, known diabetes

status, and major groups of diagnosis. None of the patients was excluded from the analysis.

RESULTS

There were 1889 participants in our study. Among these, 949 were male, and 940 were female. Overall, 24.3%(459) of admitted patients were known diabetic. It was 19.5%(185) among males, and 29.1%(274) among females. Mean age of study population was 49+19.6 years. Known diabetic were older (56.9+14.5 years) as compared to not known diabetics (46.5+20.37 years). Mean blood sugar of the study population was 210±117 mg/dl. Mean blood sugar of known diabetics was 313±125 mg/dl, while it was 177±94 mg/dl for rest of the group. Cross tabulating the hyperglycemic patients with different cutoff points showed that both diabetic as well as not known diabetic patients had fair numbers in each category of hyperglycemia. So it is not possible to say that those who are not known diabetics will not develop severe hyperglycemia (Table 2).

Among those patients who were not known diabetic (n=1430), almost 53% had blood sugar ≥ 140 mg/dl during their hospital admission, while 30% had readings ≥ 200 mg/dl (Table 1). Adding the number of known diabetics and suspected diabetics (n=889) makes a total burden of diabetic population (47%) close to half of all medical patients.

Among all admitted patients, the frequency of 'to-be treated hyperglycemia' (≥ 180 mg/dl) was 48% (906/1889). Very high blood sugar ≥ 350 mg/dl was found in 13.7% of all hospital admissions. When we cross tabulated hyperglycemic patients using cut off of ≥ 180 mg/dl, and ≥ 350 mg/dl, certain disease groups appeared with strikingly high percentages of hyperglycemic patients (Table 3).

Table 1: Possible diabetes (To be investigated) in patients who were not known diabetic (n=1430)

	Total	Male	Female
BSL ≥ 140 mg/dl	53.3% (762/1430)	52.2% (399/764)	54.5% (363/666)
BSL ≥ 200 mg/dl	30.1% (430/1430)	28.7% (219/764)	31.7% (211/666)

Table 2: Distribution of hyperglycemia according to known status of diabetes

	Known diabetic (n=459)	Not known diabetic (n=1430)
BSL ≥ 140 mg/dl (n=1194)	432	762
BSL ≥ 200 mg/dl (n=798)	368	430
BSL ≥ 350 mg/dl (n=259)	163	96

Table 3: To-be-treated hyperglycemia among all admissions in medical ward (n=1889)

	Overall	Septicemia	Renal Diseases	Liver & GI diseases	Cardiac diseases	Stroke	Respiratory diseases
BSL ≥ 180 mg/dl	48% (906/1889)	65.5% (129/197)	57.3% (59/103)	51.8% (233/450)	48.7% (129/265)	52.5% (94/179)	42.7% (35/82)
BSL ≥ 350 mg/dl	13.7% (259/1889)	20.3% (40/197)	17.5% (18/103)	13.8% (62/450)	13.6% (36/265)	12.8% (23/179)	11% (9/82)

DISCUSSION

To our knowledge, this is the first study reporting the frequency of in-patient hyperglycemia in a medical ward from Pakistan. The frequency of known diabetics in our study is based on history. Either patient or family was aware of diagnosis of diabetes, or doctors documented it in patient's file based on review of medicines patient was already taking. So we can confidently report that this figure of 24.3% is the minimum true representative percentage of diabetic population that is present in our medical wards. Authorities are encouraged to use this figure in allocating necessary resources for adequate in-patient glycemic control.

The frequency of known diabetes in our study is higher (24.3% vs 13% of USA⁵, and matches well (23.8%) with that from Turkey⁶ and (24.7%) from Australia⁷ and to cardiac patients in Pakistan^{9,10}. However, probable diabetes (≥ 200 mg/dl) is alarmingly high in our study (30% as compared to 4.5% from US and 12.3% from Turkey). It reflects poor surveillance of diabetes at our primary health care level that needs to be improved. Same time, it highlights the importance of Endocrine Society's recommendation for universal checking of blood sugar of all admitted patients.

There were a large number of hyperglycemic patients (to be investigated and to be treated, both) in those who were not diagnosed diabetics. Using a cut-off of 180 mg/dl, half of admissions in medical ward need some treatment for hyperglycemia. If we use the criteria of BSL ≥ 200 mg/dl to label all patients with diabetes, it makes 47% of total admitted patients, counting 30% as newly diagnosed diabetic patients. This is a huge burden as compared to those reported from US (12.6%) and Turkey (12.3%), and (3.4%) from Hawaii⁸.

Our comments regarding these findings are that there should be a huge number of undiagnosed diabetics among these and rest of them would be stress hyperglycemic. Though HbA1c can be used as for diagnosis of occult diabetes in hyperglycemic hospitalized patients suitable for this test¹³, we were not able to follow them up nor we did HbA1c on all these patients, so we are unable to say with confidence that how much of these patients were also diabetics. We suggest that this category of patients who are hyperglycemic during admission but not diagnosed with diabetes or otherwise should be adequately followed up or investigated with HbA1c wherever suitable with whichever way. This may give us more precise figures regarding burden of disease.

In our study, more females were known to have diabetes as compared to males. We cannot comment on cause, yet more chances of outdoor physical

activity could have contributed to less number of diabetics in males. On the other hand, it could also reflect a poor medical attention to our female population could have resulted in more serious conditions needing admission in hospital. It is interesting to note that in National Diabetes Survey of Pakistan in 2006, prevalence of diabetes as well as impaired glucose tolerance was significantly higher in women particularly from urban areas¹⁴. Findings in our study could be a reflection of higher prevalence of diabetes in women.

The mean blood sugar of our whole study population was 210mg/dl, while it was 313 mg/dl in those who were known to have diabetes. This is higher than that from US (299mg/dl) and that from Turkey (173 mg/dl for non-surgical patients)^{5,6}. In our patients, this may reflect already poor glycemic control worsened by stress of illness. Mean age of our study population was 49 years as a whole, and 56.9 years for diabetic group. This age is younger as compared to that reported from US (61 years in diabetics) and 72 years from Australia⁷. These results have two important implications. We have a huge burden of known diabetes that is no less than that in rest of the world. Second is that this burden is present at much younger age as compared to that in rest of studies cited. If this situation persists, and these diabetic patients are getting older with complications and more young patients adding into the pool of diabetics, we are going to face a huge burden of diabetes in our hospitals in near future that may outnumber our resources. This could be wrecking to our health system.

We identified a fair percentage (13.7%) of patients who have severe hyperglycemia (≥ 350 mg/dl) that may end up in hyperosmolar crisis. These patients usually need insulin infusions, frequent monitoring and justified fluid replacement. All these things require adequate training of staff, dedication of clinicians and nursing staff, and adequate provision of facilities by administration. Hospital authorities should take this into account during resource allocation.

We identified certain groups of patients who frequently had high blood sugar levels. We stress that hospitals should adopt policies to screen these patients at least, if not possible for all, for high blood sugar on admission. Severe hyperglycemia (≥ 350 mg/dl) was also frequent in same groups of patients. This makes another reason why the case is stronger for essential checking of blood sugar levels in these groups. Moreover, in certain groups like cardiac, and stroke patients, there is established evidence of beneficial effect of adequate treatment of hyperglycemia and harm of non-treatment¹⁵. So it

seems prudent to check these patients from prognostic point of view as well.

A practical limitation of our study that we feel is that we did not discriminate between critically ill and non-critically ill patients in calculating frequencies. This is important to highlight because approved treatment pathways for hyperglycemia are different for critical and non-critical patients¹. This limitation is partly because of inherently little effort in triage of patients in our healthcare system to certain clinical care pathways, and secondly due to shortage of resources leading to most sick patients being treated in wards who should otherwise be labeled as critically ill & treated in ICU facility. It was not possible to accurately determine the critical nature of patient in retrospective study like ours. We however aim to do so in our future prospective studies.

This study is important in two ways; first for the treating physicians regarding different frequency figures of hyperglycemia as a whole and in various disease groups, and secondly for hospital administrations for adequate resource allocation. This study should serve as basis for further research in inpatient hyperglycemia management, and a response to ADA call for action in managing this important aspect. At this point, however, we feel it important to highlight that this is the data from one general medical unit from a busy tertiary care hospital, and it does not at all reflect the burden of disease in whole hospital. There is a lot more to see in medical specialties, surgical wards, and gynecological patients, who may also have an enormous burden of this treatable factor whose adequate management may improve the length of hospital stay, mortality outcome, recurrent admission, and long term complications.

CONCLUSION

This study shows a huge burden of hyperglycemia and possibly undiagnosed diabetics in medical inpatients and at a younger age than in counterpart studies. We need to be vigilant in screening all patients for high blood sugar levels, treating that could improve the patient outcome.

REFERENCES

1. Draznin B, Gilden J, Golden SH, Inzucchi SE, for the PRIDE investigators. Pathways to quality inpatient management of hyperglycemia and diabetes: a call for action. *Diabetes Care*. 2013; 36: 1807-14
2. Umpierrez GE, Hellman R, Korytkowski MT, Kosiborod M, Maynard GA, Montori VM, et al. Management of hyperglycemia in hospitalized patients in non-critical

- care setting: an Endocrine Society clinical practice Guideline. *J Clin Endocrinol Metab*. 2012; 97: 16-38.
3. Moghissi ES, Korytkowski MT, DiNardo M, EinHorn D, Hellman R, Hirsch IB, et al. American Association of Clinical Endocrinologists and American Diabetes Association consensus statement on inpatient glycemic control. *Diabetes Care*. 2009;32: 1119–31.
4. Diabetes UK (UK). Position statement. Inpatient care of people with diabetes in England. June 2014. [Internet]. London (UK). [Cited: 2015 Dec 29]. Available from: <https://www.diabetes.org.uk/Documents/Position%20statements/diabetes-uk-position-statement-inpatient-care-0614.pdf>
5. Levetan C, Passaro M, Jablonski K, Kass M, Ratner R. Unrecognized diabetes among hospitalized patients. *Diabetes Care*. 1998; 21(2):246-9.
6. Yavuz DG, Yazici D, Ozcan S, Tarcin O, Deyneli O, Akalin S. Hyperglycemia in hospitalized patients. *Marmara Med J*. 2013; 26: 68-71.
7. Bach LA, Ekinci E, Engler D, Gilfillan C, Hamblin PS, MacIsaac RJ, et al. The high burden of inpatient diabetes mellitus: the Melbourne public hospitals inpatient diabetes audit. *Med J Aust*. 2014; 201(6): 334-8.
8. Sentell TL, Cheng Y, Saito E, Seto TB, Miyamura J, Mau M, et al. The burden of diagnosed and undiagnosed diabetes in native Hawaiian and Asian American hospitalized patients. *J Clin Transl Endocrinol*. 2015; 2: 115-24.
9. Ahmed N, Kazmi S, Nawaz H, Javed M, Anwar SA, Alam MA. Frequency of diabetes mellitus in patients of acute coronary syndrome. *J Ayub Med Coll Abbottabad*. 2014; 26(1): 57-60
10. Hayat U, Khan M, Kazmi NHS, Ali N, Rabnawaz, Mufti WA, et al. Frequency of newly diagnosed diabetics in patients with acute myocardial infarction. *J Ayub Med Coll Abbottabad*. 2014; 26(3): 368-70
11. Rajput R, Yousfani AH, Shaikh MA. Effect of stress hyperglycemia on mortality rate among ischemic stroke patients. *Med Channel*. 2011; 17(2): 32-5
12. Saif M, Saif I, Khan MN, Jehanzeb, Anwar W. Stress hyperglycemia and mortality in patients with acute ischemic stroke. *Pak Armed Forces Med J*. 2006; 56(2): 120-4
13. Khan SA, Ibrahim MN, Haq AU. Frequency and mortality associated with hyperglycemia in critically ill children. *J Coll Physicians Surg Pak*. 2015; 25(12): 878-81
14. Greci LS, Kailasam M, Malkani S, Katz DL, Hulinsky I, Ahmadi R, et al. Utility of HbA1c levels for diabetes case finding in hospitalized patients with hyperglycemia. *Diabetes Care*. 2003; 26: 1064-8.
15. Shera AS, Jawad F, Maqsood A. Prevalence of diabetes in Pakistan. *Diabetes Res Clin Pract*. 2007; 76(2): 219-22.
16. Lleva RR, Inzucchi SE. Hospital management of hyperglycemia. *Curr Opin Endocrinol Diabetes Obes*. 2015; 18(2): 110-8.