Print ISSN: 2319-2003 | Online ISSN: 2279-0780

IJBCP International Journal of Basic & Clinical Pharmacology

DOI: http://dx.doi.org/10.18203/2319-2003.ijbcp20190669

Original Research Article

Insulin prescribing pattern in geriatric type 2 diabetic mellitus patients of different nutritional status at a tertiary level of health care: a retrospective study

Deidre L. Dias[1]*, Edwin J. Gomes[2]

[1]Department of Pharmacology, [2]Department of Medicine, Goa Medical College and Hospital, Bambolim, Goa, India

Received: 11 January 2019
Accepted: 09 February 2019

***Correspondence to:**
Dr. Deidre L. Dias,
Email: deidrelivradias@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The world, specifically India is witnessing a steady increase in elderly population. The numbers are expected to escalate by 3 million by 2050 considering India alone. Further, the diabetic population is also increasing, and India will be home to the highest population of diabetic patients. It is thus indispensable to understand the prescribing patterns in elderly diabetics where insulin is inevitably added later in the course of diabetes, if not earlier.
Methods: Data was extracted from a diabetic registry maintained of patients attending the outpatient departments of a tertiary health care between 2009 to 2012 and having completed one year of regular three-monthly follow ups. Data was entered into MS Excel, analysed using IBM SPSS software and presented in the form of percentages or averages.
Results: Out of the total 180 male predominated type 2 diabetics aged 60 years and above, 142 (78.8%) elderly patients received a single type of insulin each day. 102 (56.6%) patients were on human insulins while 82 (45.5%) were receiving analogues. As for premixed insulins, 62 (34.4%) patients were receiving biphasic insulin analogues, while 83 (46.1%) patients were receiving human premixed insulin.
Conclusions: The elderly population makes up for a huge proportion and is set to increase in the coming years. The insulin prescribing pattern in them needs to be tailor-made to suit their needs and preferences whilst maintaining a relaxed target of HbA1c control at 8mg% or less. However, it should not be too low so as to avoid unnecessary hypoglycaemic episodes.

Keywords: Elderly, Geriatric, Insulin, Type 2 diabetes mellitus

INTRODUCTION

Diabetes is a chronic endocrinological disorder wherein insulin produced by the pancreas cannot be utilized by the body or it is produced in insufficient amounts to begin with. Thus, these two scenarios are classified into type 2 and type 1 respectively.

Globally, in 1980, 108 million people showed a prevalence of diabetes mellitus which rose to 422 million in 2014 and an astonishing 3 million increase within the next 3 years (425million in 2017).[1,2] This rapid rise is witnessed relatively more in middle- and low-income countries such as India and China. India made up 17.2 percent of this total as of 2017, thereby being the highest rank country for diabetic populace and is expected to maintain its rank even in 2030 with a diabetic population of 79.4 million.[1,3]

Within India itself, there exists a wide variation in the diabetes occurrence between states and urbanization extent. Diabetes seems to be less prevalent in north and eastern parts of India as compared to the southern states.[4] The urban areas depicted higher pervasiveness than rural areas in India.[5]

With rise in elderly populace, the frequency of diabetes in this population also seems to be increasing. The American Diabetes Association, in 2006, determined that 8.6 million (18.3%) amongst the old Americans of 60 years and more had diabetes. India had 104 million elderly (60 or more years of age) as of a 2011 census and is expected to cross 300 million by 2050. Inspite of the growing number of elders, very few studies exist on the prevalence of diabetes amongst them. According to a technical paper on diabetes by WHO in 2016, 6.9% of the individuals aged over 50 years were found to be diabetic in 2010. However less than 50% of them were on treatment for the same.[6]

Though there exists resistance in insulin initiation in diabetic patients, most elderly population are on various types of insulin.[7] With the elderly diabetic population on the rise, an understanding of their treatment regimens, insulin types, and dosages is eminent. This article would aid in optimising the treatment regimen for the geriatric population affected by diabetes.

METHODS

Data for this study was obtained from the diabetic registry of patients on insulin maintained between 2009 through 2012. Ethical approval was not required for this study. All type 2 diabetic aged 60 years and above who visited various outpatient departments of this tertiary health care facility were included, irrespective of sex and co-morbidities.

Moreover, considering demography, individuals coming from other states, particularly those from along the borders of Maharashtra and Karnataka were also not excluded. Homogeneity was maintained such that all patients who had completed one year of regular three-monthly follow ups were selected. Patients were further filtered so as to ensure selection of only those individuals whose data was complete. Hence, a final count of 180 was drawn out of the overall set of over 1000 patients.

Data pertaining to all 180 subjects was entered into Microsoft Excel and analyzed for trends using IBM SPSS software (version 22). Body mass index (BMI) was calculated and classified as per WHO standards. Duration of diabetes and time period during which they were administered insulin was calculated backdated from the time point that they were included in the study. For elderly patients, control of diabetes was set at achieving an HbA1c value of 8mg% or less based on the recommendations by American Diabetes Association.[8]

Terms such as Multiple Dose Injection therapy (same as Basal Bolus regimen) and Non-MDI therapy (mixture of short acting and intermediate acting insulins usually administered twice a day) were adopted from a UK based diabetes community.[9] Dichotomous variable data was expressed in terms of frequencies with their percentages (n, %) while continuous variable data was presented as the mean with standard deviation (mean±SD).

RESULTS

Patient characteristics

There were 180 elderly patients had a mean age of 66.52±5.5, ranging from 60 to 84 years of age. The patients were grouped into age categories for better representation as shown in Figure 1.

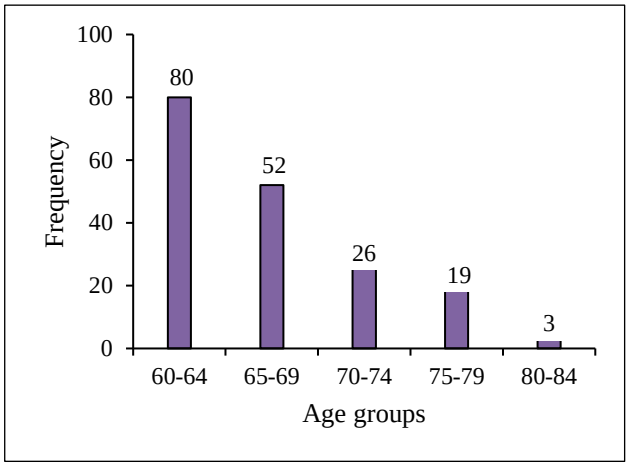

Figure 1: Age wise distribution.

Hundred and eight (60%) patients were male while 72 (40%) were females. The elderly patients in the study had a mean weight of 63.8±11.3kg, ranging from 36kg to 125kg, a mean height of 156.4±9.6cm, ranging from 102cm to 176cm and a mean BMI of 26.1±4.2, ranging from 14.8 to 48.2. Majority of the elderly patients belonged to the overweight category. Overweight category was clubbed together with obese category, and together 113 (62.7%) patients crossed the normal BMI limit, while 64 (35.6%) elderly patients belonged to the normal category as per calculated BMI as depicted in Figure 2.

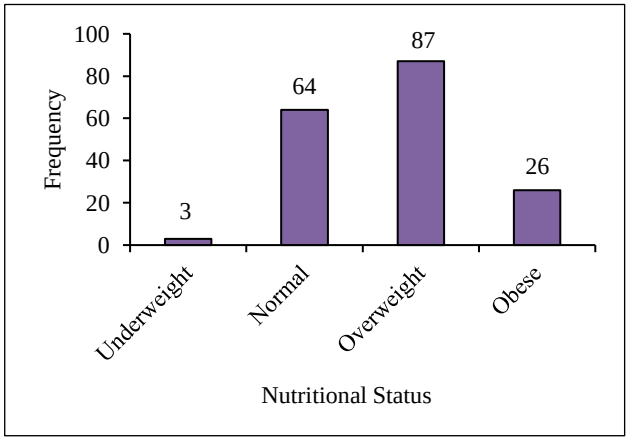

Figure 2: Nutritional status as per BMI.

Hundred and sixteen elderly patients had at-least one complication. Retinopathy was observed in 28 (15.5%) patients, neuropathy in 24 (13.3%), nephropathy in 23 (12.8%), peripheral neuropathy and peripheral vascular

disease in 5 (0.3%) each. Ischemic heart disease was detected in 82 (45.6%) and cerebrovascular accident in 10 (0.6%).

Duration of diabetes and insulin

Mean duration of diabetes known to patient was 12.5±8.5 years, ranging from a least duration of 1-week prior to enrolment up to 45 years. Insulin administration was initiated during the last 3.6 years on an average, spanning from 1-week to 20 years on insulin. Of these 180 patients, 36 (20%) were on insulin from the time of diagnosis, while a huge majority, 126 (70%) patients were started on insulin only during the last half or less of the time period that they were known to be diabetics.

Blood sugar values and control

Patients had a mean fasting blood sugar level of 131±37mg%, ranging from 64mg% to 290mg% and a mean post prandial blood sugar level of 198±57mg%, ranging from 62mg% to 418mg%. HbA1c values ranged from 6 to 13 with a mean of 7.9±1.110 (61.1%) individuals had an HbA1c value of 8 or less.

Insulin specificities

A large number, 142 (78.8%) elderly patients received a single type of insulin each day. Majority of the patients, 102 (56.6%) were on human insulins while 82 (45.5%) were receiving analogue insulins. No patient received a mix of the two types of insulin. 28 (15.5%) of the total 180 patients were on basal bolus regimen or the Multiple Dose Injection regimen (MDI) as per Figure 3.

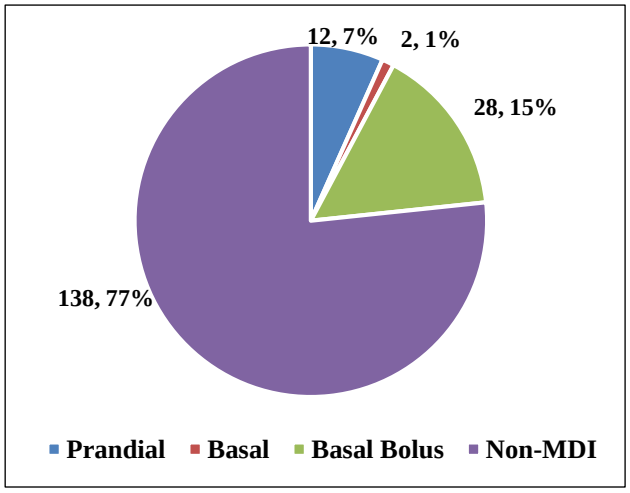

Figure 3: Insulin regimens.

138 (76.6%) of the individuals were on non-multiple dose injection (a combination of soluble insulin with isophane insulin) of which 7 were administered an additional dose of a prandial insulin once a day. Only two (0.01%) individuals were on basal only regimen. Twelve (6.6%) patients were treated to prandial insulin regimen alone out of which 6 were administered short acting human insulin and the other 6 were given rapid acting analogue insulin. 62 (34.4%) patients were receiving Biphasic insulin Analogues (BIA) while 83 (46.1%) were receiving Human Premixed Insulin (HPI).

A huge proportion, 124 (68.5%) patients received two pricks per day, 30 (16.6%) received three pricks per day, 20 (11%) received four pricks a day. Two (1.1%) patients were subjected to just one prick a day, while four (2.2%) were subjected to five pricks a day. Total daily insulin dose was 41.1±17.2 units, ranging from minimum of 12 units to 112 units.

As the number of patients in underweight category was few, they were grouped with those from the normal BMI range. Similarly, overweight and obese individuals crossing the normal mark were clubbed together and their insulin characteristics are highlighted in Table 1.

Table 1: Insulin characteristics in elderly of different nutritional status.

Insulin characteristics	Nutritional status	
	BMI ≤ 24.9 (n, %)	**BMI ≥ 25 (n, %)**
Single type	53, 29.4	89, 49.4
Multiple type	14, 7.7	24, 13.3
Human	35, 19.4	67, 37.2
Analogue	33, 18.3	49, 27.2
Prandial	5, 2.7	14, 7.7
Basal	1, 0.5	1, 0.5
Basal-Bolus	11, 6.1	17, 9.4
Non-MDI	52, 28.9	86, 47.8

Oral hypoglycaemic agents

Ninety-six (53.3%) of the patients were on concomitant Oral Hypoglycaemic Agents (OHAs). 83 (46.1%) patients received a single OHA in addition to insulin while 10 (5.5%) individuals received two additional OHAs. Along with insulin, 83 (46.1%) patients were on biguanides (metformin) alone, three (1.6%) on sulphonyl-urea alone, nine (5%) on biguanide with one sulphonyl-urea. One (0.5%) patient was on a combination of meglitinide with biguanide (repaglinide + metformin).

DISCUSSION

This retrospective study represents the trend of insulin in 180 elderly patients selected from a database of over a period of 4 years, where the patients attended the outpatient departments regularly for at-least a year before enrolment.

As age advances, the number of elderly in higher age groups keeps decreasing. A similar trend was seen in a nine yearlong study done from 2005 to 2013 in Japan and eight yearlong study done in USA from 2006 to 2013.[10,11]

However, a study done in Canada based on 12 years data from 2002 to 2013, showed a higher proportion of elderly belonging to the 70-74 age group as compared to the 65-69 age group.[12] All three studies comprised mostly of male patients much like this study.[10-12] The mean BMI of this data is similar to the mean BMI of 24.7±4.3 of Japanese elderly populus.[10]

According to the study by Clemens et al, neuropathy and retinopathy were less than 2% each amongst the Canadians which is in stark contrast relative to the current study data. Also, peripheral vascular disease and cerebrovascular accident in the Canadian study were marginally higher than this data. A possible explanation for the extremely high rates of retinopathy and neuropathy in this study is the ease of detection in the centre as it is a tertiary care hospital with advanced facilities housed in the same block and free of cost in contrast to the Canadian study which included patients from different levels of health care.[12] A study done in Korea and the US had an IHD prevalence of around 21%, equivalent to half the prevalence in this data. CVA prevalence of 15.5% in the Korean study was substantially higher than 3.9% in the US study and 0.6% in this study.[13,14]

The large Indian cohort had a mean duration of diabetes of 12.24 ±7.6 years and an average of 3.42±4.18 years where patients were on insulin.[15] Both the values are very similar to this retrospective study. According to a study done by Alvarsson et al, initiating insulin early in the period after diagnosis of diabetes results in better metabolic control and preservation of beta cells of pancreas.[16] Unfortunately, majority of the Indian population is started on insulin only after more than half of the duration has passed being a diabetic, emphasizing the clinical inertia to start even elderly patients on insulin.

According to the Japanese study, the elderly had a mean HbA1c of 7.3 (6.8 -7.9) comparable to the mean of 7.9±1.1 in this study.[10] In order to assess control, keeping the target value relaxed at 8mg% for elderly patients helps avoid the unnecessary increase in hypoglycaemic episodes. Also, older adults nearing the life expectancy must be allowed a much more lenient diet of their choice and a relaxed HbA1c allows that.

Physicians in India are more likely to choose premixed insulins over others. This was confirmed in this study as well as the study by Baruah et al.[15] A similar finding was seen in a study done in Nepal.[17] Human insulin was prescribed in 58.96% of individuals in the large Indian cohort while 35.7% were on analogue insulin, which is in line with the findings of this study.[15] This could be either be due to the patients' preference to continue on a medication they are already well-versed with or the prescribing physician's uncertainty in the mentality of old patients to accept the change from human to analogue without errors.

The mean total daily dose of insulin as per the large Indian cohort was 33.36±18.44 units, which is marginally lower than that in this study. However, with respect to the number of pricks and proportions receiving specific number of pricks, both data are extremely similar. Both the studies also revealed two pricks as the most common.[15] Further, number of pricks plays a role in compliance. Hence most individuals are started on insulin regimens involving 1 to 2 pricks.

When considering OHA amongst elderly population, metformin (biguanide) was the most often prescribed OHA in countries such as USA, Canada and Thailand. This is in contrast to China where sulphonyl-ureas were most prescribed for the old and dipeptidyl peptidase-4 inhibitors in Japan.[10] However, a large study conducted from 2006 to 2016 in India showed an identical proportion of patients being on insulin versus those on insulin along with OHA. Metformin was the most commonly prescribed OHA followed by sulphonyl-ureas in the large cohort as well as this study group.[15]

Every prescribed insulin was available free of cost to all patients from the government pharmacy within the tertiary care centre itself. Hence, cost was not a factor in the pattern seen.

However, some limitations exist. Number of hypoglycaemic episodes was not recorded and hence could not be commented upon. Secondly, the data belonged to only outpatient departments, where patients' preferences in their treatment play a major role. This, however, does not hold true for hospitalised old diabetic patients where the insulin regimen and pattern are based on the patient's co-morbidity and severity of illness. Hence the existence of same pattern cannot be assumed in hospitalized patients.

CONCLUSION

This study along with the other studies can be used to conclude that insulin pattern in elderly is of no specific kind. It is individualized to every patient based on his/her preferences, the availability of a family member or care-taker to either monitor the self-administration of the medication to the elderly or themselves administer the drug to the old. It is also based on their declining memory that makes them choose rapid acting analogues which can be given after a meal or the simple need to have their food while it is still hot. The ultimate goal of the treatment should be to achieve a relaxed control in the elderly with an upper limit of HbA1c of 8mg% and fewer episodes of hypoglycaemia as possible through a trusted and tested compliance.

ACKNOWLEDGEMENTS

Authors would like to thank Dr. Sushama A. Bhounsule, Professor and Head of department of Pharmacology for her support, Goa Medical College and Hospital for the efforts concentrated in maintaining such a registry and making it

accessible for this study. Lastly, and very importantly, the elderly patients and their families that have visited the centre and have willingly shared their data with us at the cost of their time.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. International Diabetes Federation. IDF SEA members. Available at: https://www.idf.org/our-network/regions-members/south-east-asia/members/94-india.html. Accessed on 7 January 2019.
2. World Health Organization. Diabetes, 2018. Available at: https://www.who.int/news-room/fact-sheets/detail/diabetes. Accessed on 7 January 2019.
3. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. Australas Med J. 2014 Jan 31;7(1):45-8.
4. Gupta R, Misra A. Type 2 diabetes in India: regional disparities. Brit J Diab Vas Dis. 2007 Jan;7(1):12-6.
5. Mohan V, Mathur P, Deepa R, Deepa M, Shukla DK, Menon GR, et alc. Urban rural differences in prevalence of self-reported diabetes in India-The WHO-ICMR Indian NCD risk factor surveillance. Diab Res Clin Prac. 2008 Apr 1;80(1):159-68.
6. World Health Organization. Diabetes, scale up prevention, strengthen care and enhance surveillance, 2016. Available at: http://www.searo.who.int/india/mediacentre/events/world_health_day/whd-technical-paper-4-april.pdf?ua=1. Accessed on 7 January 2019.
7. Levin PA, Wei W, Zhou S, Xie L, Baser O. Outcomes and treatment patterns of adding a third agent to 2 OADs in patients with type 2 diabetes. J Managed Care Pharm. 2014 May;20(5):501-12.
8. Association AD. Glycemic Targets: Standards of Medical Care in Diabetes-2018. Diabetes Care. 2018 Jan 1;41(Supplement 1):S55-64.
9. Diabetes.Co.UK: the global diabetes community. Multiple dose insulin injection therapy-multiple daily injections. Available from: https://www.diabetes.co.uk/insulin/multiple-dose-insulin-injection-therapy.html. Accessed on 7 January 2019.
10. Yamamoto-Honda R, Takahashi Y, Mori Y, Yamashita S, Yoshida Y, Kawazu S, et al. Changes in antidiabetic drug prescription and glycemic control trends in elderly patients with type 2 diabetes mellitus from 2005-2013: an analysis of the national center diabetes database (NCDD-03). Intern Med. 2018 May 1;57(9):1229-40.
11. Lipska KJ, Yao X, Herrin J, McCoy RG, Ross JS, Steinman MA, et al. Trends in drug utilization, glycemic control, and rates of severe hypoglycemia, 2006-2013. Diabetes Care. 2017;40(4):468-75.
12. Clemens KK, Shariff S, Liu K, Hramiak I, Mahon JL, McArthur E, Garg AX. Trends in antihyperglycemic medication prescriptions and hypoglycemia in older adults: 2002-2013. PloS one. 2015 Sep 3;10(9):e0137596.
13. Kim HM, Seong JM, Kim J. Risk of hospitalization for hypoglycemia among older Korean people with diabetes mellitus: Interactions between treatment modalities and comorbidities. Medicine. 2016 Oct;95(42).
14. Selvin E, Parrinello CM, Daya N, Bergenstal RM. Trends in insulin use and diabetes control in the US: 1988-1994 and 1999-2012. Diabetes Care. 2016 Mar;39(3):e33-5.
15. Baruah MP, Kalra S, Bose S, Deka J. An audit of insulin usage and insulin injection practices in a large Indian cohort. Indian J Endocrinol Metab. 2017 May 1;21(3):443.
16. Alvarsson M, Sundkvist G, Lager I, Henricsson M, Berntorp K, Fernqvist-Forbes E, et al. Beneficial effects of insulin versus sulphonylurea on insulin secretion and metabolic control in recently diagnosed type 2 diabetic patients. Diabetes Care. 2003 Aug 1;26(8):2231-7.
17. Kumar Shrestha H, Tamrakar R, Shrestha A, Amatya SR. Insulin Prescription Pattern among Type 2 DM patients visiting Outpatient Department at a Tertiary Hospital in Kathmandu, Nepal. J Diabetes Endo Assoc Nepal. 2018;1(1):3-7.

Cite this article as: Dias DL, Gomes EJ. Insulin prescribing pattern in geriatric type 2 diabetic mellitus patients of different nutritional status at a tertiary level of health care: a retrospective study. Int J Basic Clin Pharmacol 2019;8:584-8.