Review Article

Diabetes in the Elderly: Critical Appraisal in Management

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ABSTRACT

Majority in the elderly have type 2 diabetes mellitus (T2DM) which manifest in two ways (i) pre-existing diabetes since its onset in young adulthood or middle ages- so called Diabetes of Median age (55.28%), and (ii) Diabetes occurring for the first time in geriatric age (44.72%) - so called Diabetes of the senile age. One of the views which has been forwarded (rightly) by this consensus group is that it takes 8 years for aggressive glycemic control to reduce the risk of diabetic microvascular complication, but only 2 years of treating hypertension and dyslipidemia to reduce the risk of cardiovascular disease; hence both morbidity and mortality can be reduced more by targeting cardiovascular risk factors than by intensively managing hyperglycemia. The major two factors which compound the problem in the elderly are hypoglycemia unawareness resulting mainly from lack of autonomic warning symptoms, and delayed psychomotor responses to intervene in the correction of hypoglycemi. The most dangerous form is silent nocturnal hypoglycemia which may present in an atypical manner simulating cerebro-vascular accident. It is reassuring that in patients with type 2 diabetes, hypoglycemia due to insulin is usually not severe. Such evidence and wisdom should be taken into consideration by the care provider so that insulin therapy in the deserving patient is not delayed inappropriately. The advent of novel insulin analogues has improved the safety and convenience of insulin therapy. Insulin has no upper dose limit and, unlike other ant diabetic agents, it has no contraindications to its use. A general diabetes education, good nutritional supplement to improve metabolic outcomes and proper physical activity are important aspects to be considered in diabetes management of elderly patients.
INTRODUCTION

The age of 60 or 65, roughly equivalent to retirement ages in most developed countries is said to be the beginning of old age. At the moment, there is no United Nations (UN) standard numerical criterion, but the UN agreed cutoff is 60+ years to refer to the older population. In some cases, persons aged over 65 are elderly while those above 75 are elderly population.

With technological advances, the phenomenon of population ageing has become universal. Almost 10% of the population in developed countries and 5 to 8% in the developing countries are over the age of 60 years. In India, the absolute size of the elderly population was projected to be is 70 million for the year 2001. Elderly population contributed to 7% of total population in India in 2001 and it will rise to 9% by 2016. By 2010, 100 million people will be in this age group (70 million in 2000) and by 2020 it will be 177 million. According to an estimate they will constitute one third of total population of the world by 2050 AD. The projected number of diabetics amongst individuals above the age of 65 year is 60 million, an estimate that is expected to more than double by the year 2030. The prevalence of diabetes amongst such elderly is said to be 20% or more. Eventually, by the age of 75 years, 40% of all individual would have some form of dysglycaemia, i.e. glucose intolerance or frank diabetes mellitus.

IS DIABETES DIFFERENT IN GERIATRIC PATIENT?

Certain disabilities and morbidities which are the characteristics of elderly people greatly affect their capacity to withstand the stress of diseases, and so also the quality of life. Diabetes mellitus may behave in a little different way in certain aspects which are worthy of discussion here. There is direct correlation between advancing age and the rise in plasma glucose levels. While such rise is nominal in case of fasting plasma glucose (1-2mg/dl per decade), but is quite prominent in the post prandial state (up to 15mg/dl per decade). Both non-insulin dependent glucose disposals especially during hyperglycemia as well as glucose dependent insulin disposal are impaired. Majority in the elderly have type 2 diabetes mellitus (T2DM) which manifest in two ways (i) pre-existing diabetes since its onset in young adulthood or middle ages- so called Diabetes of Median age (55.28%), and (ii) Diabetes occurring for the first time in geriatric age (44.72%) - so called Diabetes of the senile age, with few cases of T1 or other rare variety also being seen. While those belonging to group (i) have increased insulin resistance, increased hepatic glucose output and an abnormal insulin response to glucose load, those in group (ii) are usually lean and secrete markedly less insulin in response to a glucose load but have relatively less insulin resistance. Obviously the later group has marked post-prandial hyperglycemia in the face of near normal fasting blood glucose.

SETTING GLYCEMIC TARGET IN THE ELDERLY: THE CONSTRAINTS

Life expectancy is largely determined by functional status of an individual and presence of different co-morbidities. The estimated net benefits of treating to intensive glucose control (HbA1c 7%) vs. moderate glucose control (HbA1c 7.9%) is only modest at best, as suggested by a computerized stimulation model, which in turn would mean a gain in additional quality adjusted days ranging from 51 to 116 only. The expected benefit decreased substantially as the co-morbidity and functional impairment scores increased. The last two factors may be more important predictors of reduced benefits of intensive glucose control than age alone.
life expectancy has been suggested as a threshold for identifying older patients who are unlikely to benefit from intensive glucose control.\textsuperscript{19} The American geriatric society strongly recommends individualizing the target setting of diabetes care in the elderly and has included in their guidelines six geriatric syndromes such as polypharmacy, depression, cognitive impairment, urinary incontinence, injurious falls, and pain which should get priority over endeavors to achieve a tight glycemic goal. One more view which has been forwarded (rightly) by this consensus group is that it takes 8 years for aggressive glycemic control to reduce the risk of diabetic microvascular complication, but only 2 years of treating hypertension and dyslipidemia to reduce the risk of cardiovascular disease; hence both morbidity and mortality can be reduced more by targeting cardiovascular risk factors than by intensively managing hyperglycemia.\textsuperscript{20} In a recent joint position statement, the American Diabetes Association (ADA), American Heart Association and American College of Cardiology, based on the findings of Veterans ‘Affairs Diabetes Trial (VADT), Action to Control Cardiovascular Risk in Diabetes (ACCORD), and the Action in Diabetes and Vascular Disease: Preterax and Diamicron-Modified Release Controlled Evaluation(ADVANCE) trials, suggested that the potential risk of intensive glycemic control may outweigh its benefits in patients with a very long duration of diabetes, a known history of severe hypoglycemia, advanced atherosclerosis and advanced age/frailty.\textsuperscript{21}

### Table1. Targets of diabetes control

<table>
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<tr>
<th></th>
<th>American Diabetes Association</th>
<th>Department of Veterans Affairs</th>
<th>American Geriatric Society</th>
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<tr>
<td>Hemoglobin A1c</td>
<td>&lt;7.0%</td>
<td>&lt; 7.0% in adults with life expectancy of &gt; 15 years along with good functional status (no major co-morbidity)</td>
<td>&lt;7.5% in adults who have good functional status</td>
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<td>8.0% if frail or if life expectancy is 5–15 years (, in presence of moderate t co-morbidities)</td>
<td>8% if frail or if life expectancy is &lt;5 year)</td>
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<td></td>
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<td>9% if life expectancy is &lt; 5 years (major co-morbidities)</td>
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Source: Ref 10

### SAFETY ISSUES AND MONITORING OF THERAPY AND GLYCEMIC CONTROL

Hypoglycemia is one of the major limiting factors in glycemic control by pharmacological means. In major interventional studies, intensively treated patients experienced two to threefold higher incidence of hypoglycemia. There is exponential
rise in the incidence of hypoglycemia with age. The incidence per person-years vary from 1.23 to 2.78 depending on the type pharmacological modality used. Apart from the risk factors listed in the table 2 which is applicable to diabetic from all age groups, two factors which compound the problem in the elderly are hypoglycemia unawareness resulting mainly from lack of autonomic warning symptoms, and delayed psychomotor responses to intervene in the correction of hypoglycemia. The most dangerous form is silent nocturnal hypoglycemia which may present in an atypical manner simulating cerebro-vascular accident. Only alertness on the part of the patient (self monitoring, maintaining regularity in meals, regulating physical activity etc), and the care provider (choosing the right pharmacotherapy, down titrating the dose at the earliest indication, taking the co-morbidities into considerations etc) can avert such adverse events.

Table 2 : Risk factors for hypoglycemia in elderly patients.

- Dietary errors
- Alcohol intake
- Autonomic neuropathy & adrenergic blocking agents
- Cognitive impairment
- Complex regimens
- Hepatic dysfunction
- Polypharmacy
- Poor nutrition
- Recent hospitalization
- Renal insufficiency
- Sedative agents
- Therapy with sulfonylureas or insulin
- Tight glycemic control

Modified from Harrick T et al, Ref 10

Although insulin is generally believed to be associated more with hypoglycemia compared to oral drug, the findings of an open cross-sectional study undertaken to audit safety of self-management amongst elderly (age > 65 yr) patients with insulin-requiring diabetes mellitus implied that hypoglycemic attacks were associated with too little food in 42 %, late meals in 17 %, missed meals in 11 %, too much exercise in 28 % and too much insulin in only 6 %. It is reassuring that in patients with type 2 diabetes, hypoglycemia due to insulin is usually not severe. Such evidence and wisdom should be taken into consideration by the care provider so that insulin therapy in the deserving patient is not delayed inappropriately.

PHARMACOTHERAPY: WHEN AND WHAT TO CHOOSE

Ageing is associated with changes in pharmacokinetics and pharmacodynamics parameters which have significant bearing on the pharmacological management of diabetes mellitus. Oral anti diabetic agents have been the cornerstone of hyperglycemia management in the elderly with more than 70% of prescriptions of these drugs are for individuals over the age of 60 years. With the availability of agents acting through the incretin pathways clinicians now have safer options of
impacting anti hyperglycemic therapy without the risk of hypoglycemia and possibly no weight gain\textsuperscript{28}.

As regards the pathogenesis, the diabetes of median age (see above) to which most of the elderly diabetic belongs, the disease has already been there for fairly long period to see primary or secondary failure of oral hypoglycemic drugs, necessitating insulin therapy.\textsuperscript{29} In the senile diabetes, beta cell hypo function caused by regional pancreatic vascular damage which in turn is a part of generalized atherosclerotic degeneration is evident from the beginning.\textsuperscript{30} Hence it is no surprise that this latter category of diabetic fail to response to oral drugs even if the glycemic excursions are not severe at all, or at best, moderate. Such a phenomenon is present within few years into the onset of the disease. Therefore it is highly likely that most of the elderly diabetic patients would eventually require insulin. In those who do not and continue to be eligible for oral therapy, the relative contraindications to various oral agents due to altered pharmacokinetic and pharmacodynamic as well as presence co-morbid conditions compound the problem of prolonged use of oral drugs.\textsuperscript{28}

Over the past decade, eight classes of drugs have been used to treat diabetes: sulphonylureas, biguanides, alpha-glucosidase inhibitors, meglitinides, thiazolidinediones, exenatide, dipeptidyl peptidase IV inhibitors, and pramlintide. However, insulin remains the most effective and least costly treatment for older adults.\textsuperscript{31} The advent of novel insulin analogues has improved the safety and convenience of insulin therapy.\textsuperscript{32} However; there are still some controversies on the superiority of insulin analogues over human insulin in terms of cost/benefit profile. The American Diabetes Association has recommended that the approach to drug therapy of diabetes consider insulin a first-tier therapy.\textsuperscript{33} Insulin has no upper dose limit and, unlike other ant diabetic agents, it has no contraindications to its use.\textsuperscript{34} Nevertheless, there is a general reluctance among physicians and patients alike to accept insulin. The fear of injections, the need for multiple daily glucose tests, and the perceived risks of hypoglycemia have been major deterrents to the widespread acceptance of insulin as first-line therapy. The initiation of insulin therapy is especially challenging in older adults, who often have multiple co-morbidities and physical limitations.

**OTHER IMPORTANT PARADIGMS IN MANAGEMENT OF DIABETES IN OLDER ADULTS**

**General Diabetes Education:**

Persons with DM, and, if appropriate, family members and caregivers, should be given information about hypo- and hyperglycemia at diagnosis, with reassessment and reinforcement periodically as needed. The need to understand the importance of the precipitating factors, prevention, symptoms and monitoring, treatment, and notifying a healthcare professional about hypo- and hyperglycemia should be elaborated. Multidisciplinary interventions that provide education on medication use, monitoring, and recognizing hypo- and hyperglycemia can significantly improve glycemic control. The individuals should be informed about the benefits of exercise and available resources for becoming more active. The older adult who has T2DM and any caregiver should receive education about risk factors for foot ulcers and amputation. Physical ability to provide proper foot care should be evaluated.\textsuperscript{35,36}

**Nutrition:**
Nutrition for patients of diabetes must emphasize on improving metabolic outcomes by modifying nutrient intake and lifestyle. Major goals should be to attain and maintain in the normal or as close to normal range as is safely possible blood glucose, blood pressure, and lipid/lipoprotein levels. These prevent or slow the development of chronic complications of diabetes. Because many individuals may be insulin resistant and overweight or obese, strategies must focus to reduce energy intake and increase energy expenditure through physical activity. Many patients may have already tried unsuccessfully to lose weight and it is important to note that lifestyle strategies, independent of weight loss, can improve glucose control and risk factors for cardiovascular disease. Instructions may require a provider with expertise in medical nutrition therapy, and instruction may be obtained through individual or group consultation. It is important that physicians understand the general principles of medical nutrition therapy and support them for patients with diabetes. In most people, nutrition recommendations are similar to those of the general population.

Physical Activity:

Evidences have accumulated suggesting the progressive decrease in fitness and muscle mass and strength with aging is in part preventable by maintaining regular exercise. The decrease in insulin sensitivity with ageing is also partly due to a lack of physical activity. Lower levels of physical activity are especially likely in the population at risk for type 2 diabetes. A number of recent studies of exercise training have included significant numbers of older patients. These patients have done well with good training and metabolic responses, levels of adherence at least as good as the general population, and an acceptable incidence of complications. It is likely that maintaining better levels of fitness in this population will lead to less chronic vascular disease and an improved quality of life. Before beginning an exercise program, the individual with diabetes mellitus should undergo a detailed medical evaluation with appropriate diagnostic studies. This examination should carefully screen for the presence of macrovascular and microvascular complications which may be worsened by the exercise program. Identification of areas of concern will allow the design of an individualized exercise prescription which can minimize risk to the patient.  

CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

COMPETING INTERESTS

The author(s) declare that they have no competing interests'.

REFERENCES


