



## **“Person Centred Diabetes Care and Meal Planning for the Older Person”**

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UNIT NO. I

**TREATING DIABETES IN OLDER ADULTS – OPTIMISING GLYCAEMIC TARGETS WITH COMORBIDITIES IN MIND**

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**ABSTRACT**

Ageing is associated with changes in the body composition, reduced insulin sensitivity and beta-cell function, which predispose the older adults to glucose intolerance and a higher risk of diabetes mellitus. The diabetes treatment for older adults is complicated by higher rates of coexisting illnesses, functional and physical disability, cognitive impairment, and more prone to injury. The treatment goal is less stringent, with a reasonable HbA1c between 7.0 to 8.0 percent, with the aim to minimise the risk of hypoglycaemia. Medical nutrition therapy and physical activity are the cornerstones in the management, failing so, pharmacotherapy with oral or injectable diabetes medication would be needed for diabetes control. The Appropriate Care Guidelines, Ministry of Health, on Oral Glucose-Lowering Agents, and Initiating Basal Insulin in type 2 diabetes mellitus, published in 2017, have provided the framework for the use of oral glucose-lowering agents and insulin therapy for diabetes management in the general population. The diabetes management plan includes a multidisciplinary team, a greater consideration of patient factors, aspiration and goals, and risk evaluation and mitigation strategy to prevent hypoglycaemia. Easy and early access to health care is critical as older adults are prone to rapid deterioration in the clinical condition.

**Keywords:** Older adults, individualise, cautions, less stringent

SFP2020; 46(7) : 6-10

**INTRODUCTION**

Type 2 diabetes mellitus (T2DM) is a highly prevalent chronic disease in Singapore. With increasing obesity and ageing, the incidence of T2DM is projected to continue to increase. It is estimated that approximately one-quarter of older adults (defined as people over the age of 65 years) have diabetes and one-half of older adults have prediabetes. Together, with hypertension and hyperlipidaemia, T2DM confers a high risk for cardiovascular disease, chronic kidney disease, and premature death. Also, diabetes can lead to disabling retinopathy, maculopathy, and peripheral neuropathy. Altogether, T2DM and its complications reduce the quality of life and command a high treatment cost. Thus, it is imperative to prevent T2DM from happening and to prevent

complications in those with diabetes.

Data from the Singapore National Health Survey, Loh TP et al. showed a rising fasting and postprandial glucose and glycated haemoglobin (HbA1c) with age among Singaporean adults.<sup>1</sup> The rise in the two-hour post-meal glucose (2hPG) appeared more robust compared to fasting plasma glucose (FPG) or HbA1c. The diagnostic specificity of HbA1c in detecting hyperglycaemia reduces with age. In the Baltimore Longitudinal Study of Aging, Chia CW et al. reported that among 131 individuals (average age 70 years) with newly diagnosed T2D, FPG alone identified 40 (31 percent) cases, 2hPG alone identified 89 (68 percent) cases, and HbA1c alone identified 66 (50 percent) cases. If only FPG and HbA1c were used for diagnosis, more than one-third of those with T2DM would have been missed.<sup>2</sup>

**PATHOGENESIS OF T2D IN OLDER ADULTS**

Previous studies have shown that age-related changes in adiposity and physical inactivity are the primary determinants of the age-related declines in insulin sensitivity rather than chronological age.<sup>3</sup> Obese adults, regardless of young or elderly, have a lower insulin sensitivity compared to lean adults. Other studies have shown that the amount of fat mass, abdominal adiposity, and BMI are significant predictors of insulin sensitivity, independent of age.<sup>4</sup> Ageing is also associated with sarcopenia and skeletal muscle dysfunction leading to mitochondrial dysfunction, intramyocellular lipid accumulation, increased inflammation, oxidative stress, changes in the activities of enzymes that regulate insulin sensitivity, endoplasmic reticulum stress, decreased autophagy, and over-activated renin-angiotensin-aldosterone system.<sup>5</sup>

Another key factor in the pathogenesis of T2DM in elderly adults is age-related deterioration in the  $\beta$ -cell function. The mechanism underlying ageing-related  $\beta$ -cell dysfunction is not clear, and this could be due to reduced amounts of  $\beta$ -cell turnover and regenerative capacity.<sup>6</sup> Chang AM et al. showed that the insulin secretion rate in response to glucose was significantly and progressively decreased in older individuals, with the greatest impairment in older individuals with impaired glucose tolerance compared with older individuals with normal glucose tolerance or with younger individuals matched for degree of insulin resistance.<sup>7</sup> Others have reported  $\beta$ -cell mitochondrial dysfunction, reduced GLUT2 levels, accumulation of advanced glycation end products, telomeres shortening, impaired Ca<sup>2+</sup> signalling and reduced response to GLP-1.<sup>8</sup>

Age-related declines in the  $\beta$ -cell function coupled with higher insulin resistance would result in a higher risk of glucose intolerance and T2DM with ageing. Regular endurance exercise improves insulin sensitivity and mitochondrial function of ageing.<sup>4,9</sup> In another study, Bloem CJ et al. showed that a short-term exercise (seven consecutive days of aerobic exercise)

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in 12 sedentary older adults with impaired glucose tolerance significantly improved insulin sensitivity by 59 percent and  $\beta$ -cell function by 12 percent.<sup>10</sup>

## TREATMENT OF T2D IN ELDERLY ADULTS

It is often said that the treatment of T2DM should address the underlying pathophysiology. While this is true, we need to recognise this is seldom so in reality. For older adults, the treatment decision deserves deeper consideration than the younger counterpart. Older adults often have multiple comorbidities, underlying cardiovascular and kidney disease, and are polypharmacy. Loh TP et al. showed that the systolic blood pressure, pulse pressure, and LDL-cholesterol concentrations were higher in older men and women.<sup>1</sup> Also, the eGFR decreases linearly with age, implicating a higher risk of acute kidney injury during an acute illness or dehydration, and a greater consideration when deciding the choice of therapy in older adults.

It is important to individualise treatment goals and choices, taking into consideration the patient and disease factors, patient's aspiration, and life goals. Preventive medicine is critical, e.g. vaccination, heart health, bone health, and fall prevention. Patient's life expectancy, comorbidities, functional status, cognitive status, psychological status, nutritional status, dentition, ability to self-care, family support, level of dependency, and risk for hypoglycaemia will influence the goals of care. The presence of concurrent visual impairment (from cataract, glaucoma, and macular degeneration) and hearing impairment would impair the individual's ability to self-care.

Generally, the glycaemic target in older adults is less stringent, in particular those aged 70 years and above. A reasonable target for glycated haemoglobin (HbA1c) would be between 7.0 to 8.0 percent. Older adults have a less robust counterregulatory mechanism for hypoglycaemia and have a reduced ability to recognise hypoglycaemic symptoms. They may not be able to communicate the symptoms when hypoglycaemia occurs. On the other hand, an HbA1c >8.0 percent might confer a higher risk of all-cause and cause-specific mortality in older adults with diabetes.<sup>11</sup> Severe hyperglycaemia, left untreated could rapidly progress to hyperglycaemia hyperosmolar syndrome which will require emergency care and carries a high mortality rate.

## MEDICAL NUTRITION THERAPY AND PHYSICAL ACTIVITY

Medical nutrition therapy (MNT) and physical activity are the cornerstones in diabetes management, whether individuals with diabetes are young or old.

As for any individual with diabetes, the most challenging part of nutrition therapy is to determine what to eat, what to avoid and what are the compromises. There is high inter-individual variability in response to macronutrient intake, so much so the individual would need trial and error to find fit. Ideally, the use of continuous glucose monitoring (CGM) or frequent self-monitoring blood glucose (SMBG) would help to inform

on the trend of glucose abnormalities which help the health care providers and patients to focus therapy. For example, is the high glucose level seen at fasting or postprandial, if postprandial whether this is after breakfast, lunch or dinner, or is this weekday or weekend phenomenon, or is it due to eating out and better with home-cooked food? With a food diary, it might become apparent to patients of the culprit and patients might come up with solutions themselves.

Generally, for those who are overweight or obese, weight loss of 5-10 percent would help to improve the metabolic profile and decreases the risk of diabetes-related complications. As a cautionary note, weight loss also inevitably leads to loss of muscle and bone mass, which may exacerbate sarcopenia-related frailty. Protein and vitamin deficiency could occur from inadequate macro- and micronutrient intake. Ideally, a registered dietitian should assess the individual's nutritional status and help in the weight loss prescription to minimise associated lean mass loss. If weight loss is not feasible, weight maintenance with healthier food choices (e.g. reduce carbohydrate intake, change from high to low glycaemic index (GI) carbohydrate, eliminate snacks, desserts, and sweetened beverages, etc.) would be effective in glycaemic control. Also, increased fitness has been shown to halve the all-cause mortality and would be an efficient approach to address obese individuals who are not able to lose weight or maintain weight loss.<sup>12</sup>

Regular aerobic exercise helps to reduce excess body weight, improve insulin sensitivity and  $\beta$ -cell function, and to prevent lean mass and bone loss. Aerobic exercise has also been shown to improve mitochondrial function, muscle regeneration, and strength.<sup>13</sup> The recommendation of at least 30 minutes of exercise of moderate intensity at least five days per week is reasonable. Resistance exercise prevents muscle wasting as it stimulates muscle hypertrophy and increases muscle strength. Previous studies have shown that resistance training can improve physical performance and peak oxygen uptake.<sup>14</sup> Combined resistance and aerobic exercise program have been reported to improve walking and balancing abilities, isokinetic muscle functions, and endurance performance.<sup>15,16</sup> A prescriptive exercise program, in particular for those who are fragile or who have never exercised, might be needed to ensure patient safety (e.g. risk of fall, cardiac ischemia, hypoglycaemia, etc.) during and after exercise. Visual impairment, vestibular imbalance, peripheral neuropathy, and presence of arthritis can increase the risk of falls in older patients. Patients with autonomic dysfunction or on sulphonylurea or insulin therapy are at risk of hypoglycaemia during and after exercise. Lastly, sedentary (e.g. prolonged sitting) has been associated with metabolic health risks, and it is prudent to advise patients to have more break sessions during the sedentary time.

## PHARMACOTHERAPY

The choice of pharmacotherapy, between oral and injectables, would depend on the individual's functional and physical capabilities and level of dependency. Other factors include the level of glycaemia, the cost of therapy, and the need to do self-monitoring of blood sugar. It would be unrealistic to expect

strict glycaemic control with insulin therapy in a diabetes patient with poor vision and a high risk of falls. Given that the older adults would have some level of dependency, the management would require participation from the patient's family members. There is a need for greater access to health services as the older adults might require a more frequent follow-up. Empanelment to a health care provider, located near to the patient's home, would provide a better continuity of care and rapid access to tackle any medical issues as early as possible to prevent hospitalisation.

The Appropriate Care Guidelines, Ministry of Health, on Oral Glucose-Lowering Agents and Initiating Basal Insulin in type 2 diabetes mellitus, published in 2017<sup>17,18</sup>, have provided the framework for diabetes management in the general population. Briefly (Figure 1, adapted from the ACG Oral glucose-lowering agents in type 2 diabetes mellitus, 2017) establish a patient-centred glycaemic target, then individualised treatment plans based on drug and patient profiles.<sup>17</sup> Metformin is the first-line oral therapy. For second-line or combination therapy with metformin, an SGLT2 inhibitor, DPPIV inhibitor, or acarbose is preferred if the risk of hypoglycaemia is high. The presence of cardiovascular disease or renal disease would favour the use of SGLT2 inhibitor, although the evidence of safety and cardiorenal protection is lacking in older adults. Insulin secretagogue such as sulfonylurea and meglitinide is very effective in glucose lowering, but would require a risk evaluation and mitigation plan to reduce hypoglycaemia. Please refer to Table 5, the ACG Oral glucose-lowering agents in type 2 diabetes mellitus, 2017, for the properties of oral glucose-lowering agents.<sup>17</sup> Insulin therapy is recommended for individuals with severe hyperglycaemia (HbA1c >9.0 percent) and in those with symptomatic hyperglycaemia. Insulin therapy is needed when glycaemic goals are not met despite optimal and maximal tolerable oral glucose-lowering agents (Figure 1, adapted from the ACG Initiating basal insulin in type 2 diabetes mellitus, 2017).<sup>18</sup> The physician can initiate with basal insulin, intermediate- or long-acting insulin, and review concomitant oral glucose-lowering agents. Similar to oral insulin secretagogue, patients and their caregivers should be educated on preventative measures for hypoglycaemia (Refer to the section on Preventing and managing hypoglycaemia, the ACG Initiating basal insulin in type 2 diabetes mellitus, 2017).<sup>18</sup> SMBG or CGM helps with insulin titration and intensification and is useful to detect hypoglycaemia.

## CONCLUSION

With the increasing burden of type 2 diabetes in older adults, there is a need to better understand their needs and aspirations so that the health care could be delivered to maximise their quality of life while minimising the progression of disease and the potential adverse effects from the well-intended treatment.

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## LEARNING POINTS

- There is a higher burden of chronic diseases among older adults, and this factor has to be taken into consideration in diabetes management.
- Treatment goals and treatment strategy (medical nutrition therapy, physical activity and pharmacotherapy) must be individualised.
- The choice of pharmacotherapy, between oral and injectables, would depend on the individual's functional and physical capabilities and level of dependency.

Figure 1. Achieving glycaemic control in adults with T2DM

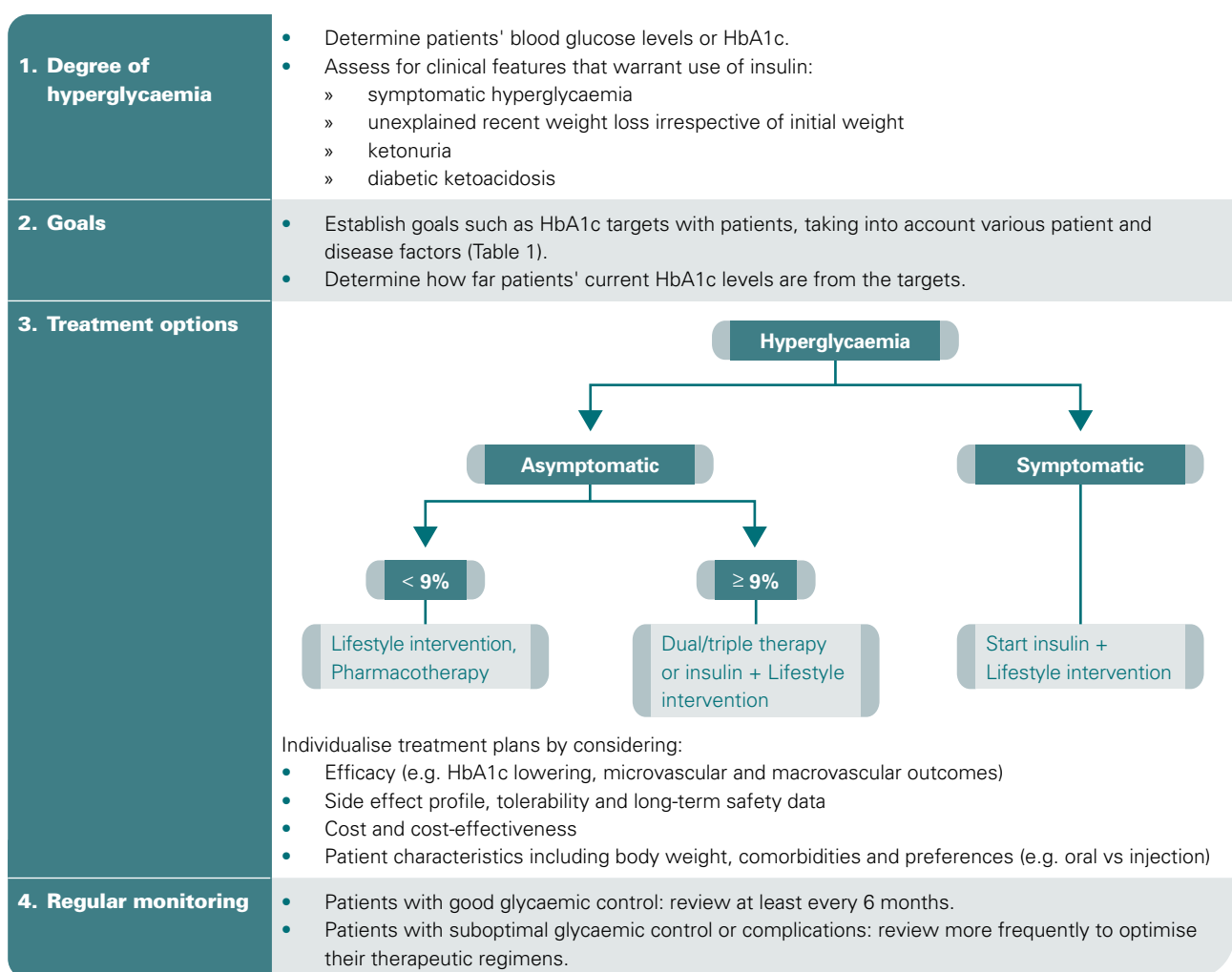




Figure 2. Algorithm for insulin therapy

