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Aspects of Diabetes and Diabetes Care: An Overview.

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ABSTRACT

Diabetes mellitus is an endocrinological and/or metabolic disorder with an increasing global prevalence and incidence. High blood glucose levels are symptomatic of diabetes mellitus as a consequence of inadequate pancreatic insulin secretion or poor insulin-directed mobilization of glucose by target cells. Diabetes mellitus is aggravated by and associated with metabolic complications that can subsequently lead to premature death. New drugs are developing to treat diabetes and these important roles have a great impact on the prevention and management of this disease which improves patient's quality of life. This review acts as a brief introduction for diabetes and its care which is a growing health care problem affecting individual's health, health care system and the economy of the whole world.

Keywords: Insulin, Blood glucose levels, Hypoglycaemia, Therapy, Standards.

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INTRODUCTION

Life style management is apparently the cornerstone of management of diabetes mellitus. It is recognized as being an essential part of diabetes and cardiovascular disease prevention. Meta-analyses demonstrate that lifestyle interventions, including diet and physical activity, led to a 63% reduction in diabetes incidence in those at high risk. Lifestyle modification programs have demonstrated encouraging improvement in risk factors for diabetes; however, the effect on diabetes incidence has not been reported. The dietary management of diabetes mellitus is a complement of lifestyle management. It has a positive effect on long term health and quality of life. Different oral hypoglycaemic have been in use to aid in maintenance of blood glucose level at the requisite threshold in diabetics through distinct mechanisms. Plant derived medications have also found immense use in the management of diabetes mellitus. Many plant species have been used to treat life- threatening diseases including diabetes mellitus. Gene therapy will doubtlessly address the complications of diabetes mellitus. The pioneering gene therapy approach to diabetes mellitus was occasioned by the cloning of the insulin gene. The strategy was based on the premise that non-insulin producing cells could be manipulated to produce insulin using a suitable promoter and insulin gene construct. It was thought that these substitute cells could reclaim insulin production diabetics [1, 2].

GLUCOSE ABNORMALITIES IN CYSTIC FIBROSIS

Cystic fibrosis (CF) is a common genetic condition and abnormal glucose handling leading to cystic fibrosis-related diabetes (CFRD) is a frequent comorbidity. CFRD is mainly thought to be the result of progressive pancreatic damage resulting in beta cell dysfunction and loss of insulin secretion. Whilst Oral Glucose Tolerance Testing is still recommended for diagnosing CFRD, the relationship between glucose abnormalities and adverse outcomes in CF is complex and occurs at stages of dysglycaemia occurring prior to diagnosis of diabetes by World Health Organisation criteria. Insulin remains the mainstay of treatment of CF-related glucose abnormalities but the timing of insulin commencement, optimum insulin regime and targets of glycaemic control are not clear. These complexities are compounded by common issues with nutritional status, need for enteral feeding, steroid use and high disease burden on CF patients. Glucose abnormalities related to CF pose unique challenges to both diabetes and respiratory teams. The close associations between worsening dysglycaemia and poor outcome suggest benefit from insulin replacement therapy, but the time to start treatment and desired cpapillary blood glucose (CBG) levels remain controversial. Insulin therapy has significant potential to cause harm—especially by inducing hypoglycaemia. It was suggested that insulin use targeting postprandial glucose excursions, initiated when risks of declining lung function and nutritional status are high [3].

DIABETIC NEUROPATHY AND GAIT

Diabetic peripheral neuropathy (DPN) is a major sequel of diabetes mellitus and may have a detrimental effect on the gait of people with this complication. DPN causes a disruption in the body's sensorimotor system and is believed to affect up to 50% of patients with diabetes mellitus, dependent on the duration of diabetes. It has a major effect on morbidity and mortality. The peripheral nervous system controls the complex series of events in gait through somatic and autonomic functions, careful balancing of eccentric and concentric muscle contractions and a reliance on the sensory information received from the plantar surface. Abnormalities in gait occur in patients with DPN and are intimately linked to alterations in kinetics, kinematics and posture. Sarcopenia related to the severity of DPN also appears to play a pivotal role. These conditions may lead to an increased risk of falls and be a significant cause of morbidity and mortality in older people with diabetes. Further detailed evaluation of gait disorders in DPN is required, particularly in terms of accurately phenotyping neuropathy in relation to gait disorders [4].

DIABETIC GASTROPARESIS

Defined as delayed gastric emptying with associated upper gastrointestinal symptoms in the absence of any mechanical obstruction, diabetic gastroparesis may present with a variety of symptoms. These include postprandial fullness, nausea, vomiting, anorexia, and weight loss, with or without abdominal pain. The long list of complaints is accompanied by an equally exhaustive list of differential diagnoses, including iatrogenic or drug-induced delay in gastric emptying. Diabetic gastroparesis is accoutred by poor glucose control, suboptimal nutritional and hydration status, greater risk of cardio vascular disease (CVD), hypertension and

retinopathy, frequent need for hospitalization, and poor quality of life. Thus, diabetic gastroparesis is not only a marker of poor current control but also a predictor of poor future outcomes [5].

CARDIOVASCULAR RISK IN TYPE 1 DIABETES MELLITUS

Type 1 diabetes mellitus (T1DM) is associated with premature cardiovascular disease (CVD), but the underlying mechanisms remain poorly understood. The American Diabetes Association and the European Association for the Study of Diabetes recently updated their position statement on the management of type 2 diabetes mellitus (T2DM) to include additional focus on cardiovascular risk; improved management of risk factors in T1DM is also needed. There are important differences in the pathophysiology of CVD in T1DM and T2DM. Hyperglycaemia appears to have a more profound effect on cardiovascular risk in T1DM than T2DM, and other risk factors appear to cause a synergistic rather than additive effect, so achievement of treatment targets for all recognized risk factors is crucial to reducing cardiovascular risk. Here we discuss the evidence for addressing established cardiovascular risk factors, candidate biomarkers and surrogate measurements, and possible interventions.

Type 1 diabetes mellitus is associated with an almost threefold higher mortality than the general population. Although the correlation between T1DM and CVD is well established, the underlying mechanisms remain poorly understood and the need for enhanced treatment is often not appreciated. It is also important that clinicians recognise that men and women with T1DM have a similar absolute risk of CVD. Glucose-lowering therapy, statin use, BP control and lifestyle interventions have improved outcomes, but individuals with T1DM continue to have a markedly elevated risk of cardiovascular events and death compared with the general population. There is therefore scope to address this residual risk through improved identification of 'at risk' individuals, and novel interventions [6].

DIABETES AND DIET

There is evidence that it is more challenging for those with type 2 diabetes to lose weight than it is for those without diabetes, and that this difficulty is exacerbated by insulin treatment, which is it associated with weight gain. One aim of weight loss is to improve (or maintain) glycaemic control while avoiding hypoglycaemia and achieving this balance requires both blood glucose monitoring and active insulin dose titration. In the weight wise program, participants are encouraged to monitor blood glucose levels between two to four times daily, and insulin titration takes place under medical supervision. An essential part of the program is carbohydrate awareness and management, with the aim to minimize the risk of hypoglycaemia.

Binge eating disorder (BED) is now a formal diagnosis and is characterized by eating large amounts of food in a discrete time period while experiencing a lack of control over eating. Prevalence rates of BED are estimated to range from 1 to 4% of the general population, and approximately 40–50% of individuals with BED are obese. External eating is characterized by eating in response to the sight, smell or taste of food rather than to internal hunger cues, and food cravings are defined as obsessive thoughts and the compulsive consumption of specific foods. Although little is known about the prevalence of these different manifestations of emotional eating, there is evidence that disordered eating generally may affect around 40% of people with type 2 diabetes and that they are more common among obese individuals than among those of normal weight [7].

GESTATIONAL DIABETES MELLITUS AND DIET

Gestational diabetes mellitus (GDM) is one of the most common medical complications in pregnancy and affects an estimated 14% of pregnancies or one in every seven births globally. Women with GDM and their offspring are at increased risk of both short- and longer-term complications, including, for mothers, later development of type 2 diabetes, and for offspring, increased lifelong risks of developing obesity, type 2 diabetes, and metabolic syndrome. The adverse intrauterine environment causes epigenetic changes in the foetus that may contribute to metabolic disorders, the so-called vicious cycle of diabetes. The mainstay of GDM treatment is dietary and lifestyle advice, which includes medical nutrition therapy, weight management, and physical activity. Women monitor their fasting and post meal glucose levels and adjust their individual diet and lifestyle to meet their glycaemic targets.

Modified dietary interventions favourably influenced outcomes related to maternal glycaemia and birth weight. This indicates that there is room for improvement in usual dietary advice for women with GDM.

Given the prevalence of GDM, new studies designed to evaluate potential dietary interventions for these women should be based in larger study groups with appropriate statistical power. As most women with GDM are entering pregnancy with a high body mass index (BMI), evidence-based recommendations regarding both dietary components and total energy intake are particularly important for overweight and obese women. The evaluation of nutrient quality, in addition to their quantity, as well as dietary patterns such as Mediterranean diet [8] would also be relevant. In particular, there is an urgent need for well-designed dietary intervention studies in the low- and middle-income countries where the global health consequences of GDM are greatest [9].

NUTRITIONAL ADVICE TO PEOPLE WITH DIABETES

Dietary advice is fundamental to the management of diabetes. Although ideally such advice should be delivered by a state-registered dietician, it is more usually delivered by other health professionals. The primary focus for those with type 1 diabetes is carbohydrate counting and insulin adjustment and for the majority of people with type 2 diabetes, weight management is key. Patient-centred care is emphasised for the delivery of dietary advice. It is widely recognised that knowledge alone is not sufficient to induce behaviour change and practical approaches to a variety of behavioural interventions are discussed. Delivering effective dietary advice for people with diabetes goes beyond supplying information and addresses the behavioural and psychosocial determinants of health behaviour change. Adopting new skills and changing their own behaviour is challenging for many healthcare professionals, and there are few education programmes available that specifically address effective consultation skills rather than increasing clinical expertise. Despite these challenges, there are practical strategies that can be incorporated into general practice and most of these strategies are not more time-consuming than standard approaches and are more effective if used appropriately [10].

NUTRITION THERAPY FOR ADULTS WITH DIABETES OR PREDIABETES

Strong evidence supports the efficacy and cost-effectiveness of nutrition therapy as a component of quality diabetes care, including its integration into the medical management of diabetes; therefore, it is important that all members of the health care team know and champion the benefits of nutrition therapy and key nutrition messages. Nutrition counselling that works toward improving or maintaining glycaemic targets, achieving weight management goals, and improving cardiovascular risk factors (e.g., blood pressure, lipids, etc.) within individualized treatment goals is recommended for all adults with diabetes and prediabetes.

Nutrition therapy recommendations need to be adjusted regularly based on changes in an individual's life circumstances, preferences, and disease course. Regular follow-up with a diabetes health care provider is also critical to adjust other aspects of the treatment plan as indicated. One of the most commonly asked questions upon receiving a diagnosis of diabetes is "What can I eat?" Despite widespread interest in evidence-based diabetes nutrition therapy interventions, large, well-conducted nutrition trials continue to lag far behind other areas of diabetes research. Unfortunately, national data indicate that most people with diabetes do not receive any nutrition therapy or formal diabetes education.

Strategies to improve access, clinical outcomes, and cost effectiveness include the following:

- Providing in-person or technology-enabled diabetes nutrition therapy and education integrated with medical management.
- Engineering solutions that include two-way communication between the individual and his or her health care team to provide individualized feedback and tailored education based on the analyzed patient-generated health data.
- Increasing the use of community health workers and peer coaches to provide culturally appropriate, ongoing support and clinically linked care coordination. Evaluating nutrition evidence is complex given that multiple dietary factors influence glycaemic management and CVD risk factors, and the influence of a combination of factors can be substantial. Based on a review of the evidence, it is clear that knowledge gaps continue to exist and further research on nutrition and eating patterns is needed in individuals with type 1 diabetes, type 2 diabetes, and prediabetes.
- The impact of different eating patterns compared with one another, controlling for supplementary advice (such as stress reduction, physical activity, or smoking cessation).

- The impact of weight loss on other outcomes (which eating plans are beneficial only with weight loss, which can show benefit regardless of weight loss).
- How cultural or personal preferences, psychological supports, co-occurring conditions, socioeconomic status, food insecurity, and other factors impact being consistent with an eating plan and its effectiveness.
- The need for increased length and size of studies, to better understand long-term impacts on clinically relevant outcomes.
- Comparisons of different delivery methods aided by technology (e.g., mobile technology, apps, social media, technology-enabled and internet-based tools) and
- Ongoing cost-effectiveness studies that will further support coverage by third-party payers or bundling services into evolving value-based care and payment models [11].

DIABETES AND AGING

Diabetes in older adults is a growing public health burden. The unprecedented aging of the world's population is a major contributor to the diabetes epidemic, and older adults represent one of the fastest growing segments of the diabetes population. Of impending concern is that these numbers are projected to grow dramatically over the next few decades. While rates of diabetes-related complications have declined overall in the general population, the incidence rates of macro vascular complications such as acute myocardial infarction and stroke continue to be the highest in older age-groups. These individuals also have the highest rate of diabetes-related end-stage renal disease. In large measure, the difficulty results from having continued gaps in research that investigates diabetes in older adults, the age-group with the highest prevalence rates of diabetes and the fastest growing segment of the population. It was recognized that given the exclusion of older participants from most traditional randomized controlled trials of diabetes interventions, treatment decisions are often made with much uncertainty and need to be individualized. Therefore, future research should allow and account for the complexity of older adults. Older adults with diabetes are a heterogeneous population ranging from the robust to the frail and represent unique challenges and considerations for both the clinician and researcher that will need to be urgently addressed in the future [12].

PSYCHOSOCIAL CARE FOR PEOPLE WITH DIABETES

Complex environmental, social, behavioral, and emotional factors, known as psychosocial factors, influence living with diabetes, both type 1 and type 2, and achieving satisfactory medical outcomes and psychological well-being. Thus, individuals with diabetes and their families are challenged with complex, multifaceted issues when integrating diabetes care into daily life. To promote optimal medical outcomes and psychological well-being, patient-centered care is essential, defined as “providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions”. Practicing personalized, patient-centered psychosocial care requires that communications and interactions, problem identification, psychosocial screening, diagnostic evaluation, and intervention services take into account the context of the person with diabetes (PWD) and the values and preferences of the PWD.

Recommendations are based on commonly used clinical models, expert consensus, and tested interventions, taking into account available resources, practice patterns, and practitioner burden. Consideration of life span and disease course factors is critical in the psychosocial care of PWD. This Position Statement focuses on the most common psychological factors affecting PWD, including diabetes distress and psychological comorbidities, while also considering the needs of special populations and the context of care. PWD must master many complex tasks and behaviours to successfully incorporate diabetes care into daily life. Disease management cannot be successful unless the lifestyle and emotional status of the individual is taken into consideration. As detailed in this position statement, routine monitoring and screening for diabetes distress, depression, anxiety, eating issues, and appropriate levels of social and family support, as well as contextual factors that impede implementation of care, are clearly indicated. Collaborative care shows the most promise for supporting physical and behavioural health outcomes.
Challenges to accomplish the standard of care are considerable, including too few qualified mental health professionals who understand living with diabetes and medical care models that are not conducive to team

care. Those in most need, the disadvantaged lower socioeconomic level families, have the poorest access to diabetes services. The psychosocial services recommended are reimbursable for mental health providers in routine medical care under Centers for Medicare & Medicaid Services (CMS). In addition, new CMS reimbursement is planned for the collaborative care model in routine care. With changing laws mandating minimum standards and payment for diabetes care services and the availability of low-cost insurance that also reimburses preventive services, this balance is changing, allowing the practitioner to incorporate previously unsupported services into routine practice. The integration of psychosocial care and ensuring access to services will benefit the PWD and the care team [13].

GENERAL MANAGEMENT OF DIABETIC PATIENT'S EDUCATION

Diabetes can be prevented through lifestyle modification, diet control, and control of overweight and obesity. Education of the populace is still key to the control of this emerging epidemic. Novel drugs are being developed, yet no cure is available in sight for the disease, despite new insight into the pathophysiology of the disease. Management should be tailored to improve the quality of life of individuals with diabetes.
Education must need:

- Disease process treatment option.
- Food plan.
- Physical activity plan.
- Awareness of given medication for diabetes.
- Monitoring of blood sugar levels.
- Awareness of acute and chronic issues.
- Psychosocial issues.
- Promoting health strategies [14, 15].

DIABETES SELF-MANAGEMENT EDUCATION AND SUPPORT

Diabetes self-management education and support (DSMES) is a critical element of care for all people with diabetes. DSMES is the ongoing process of facilitating the knowledge, skills, and ability necessary for diabetes self-care, as well as activities that assist a person in implementing and sustaining the behaviors needed to manage his or her condition on an ongoing basis, beyond or outside of formal self-management training. In previous National Standards for Diabetes Self-Management Education and Support (Standards), DSMES and DSME were defined separately, but these standards aim to reflect the value of on-going support and multiple services.

The Standards define timely, evidence-based, quality DSMES services that meet or exceed the Medicare diabetes self-management training (DSMT) regulations; however, these standards do not guarantee reimbursement. These Standards provide evidence for all diabetes self-management education providers including those that do not plan to seek reimbursement for DSMES. The current standards evidence clearly identifies the need to provide person-centered services that embrace the ever-increasing technological engagement platforms and systems. The hope is that payers will view these Standards as a tool for reviewing DSMES reimbursement requirements and consider change to align with the way their beneficiaries' engagement preferences have evolved. Research confirms that less than 5% of medicare beneficiaries utilize their DSMES benefits. Changes in reimbursement policies stand to increase DSMES access and utilization, which will result in positive impact to beneficiaries' clinical outcomes, quality of life, health care utilization, and costs [16].

USE OF NEWER ORAL COMBINATION THERAPIES EARLY IN THE DISEASE

Antihyperglycemic single-pill combinations (SPCs) have been developed in an effort to address the issues of adherence associated with combination pharmacotherapy for patients with type 2 diabetes mellitus (T2DM), with the goal of optimizing clinical outcomes. Most SPCs contain metformin or a Sulfonyl Urea (SU). On the basis of current guidelines, metformin is the preferred choice for one of the agents in combination therapy. The use of SUs is less desirable because of weight gain, hypoglycemia, and potential cardio vascular (CV) risks. When considering orally administered alternatives or additions to metformin therapy, agents with a low risk of hypoglycemia that provide weight neutrality or weight loss and have a

proven CV safety profile are preferred. In managing diabetes, early diagnosis and treatment with better lifestyles and proper medications can normalize HbA1c without hypoglycemia and/or weight gain. The use of SPC therapy is recommended for better adherence, and a more aggressive early treatment should result in fewer complications and a better quality of life. Consideration is needed in every case to provide a patient-centered approach that treats the patient as a whole. This necessarily includes taking into account concomitant risk factors such as obesity, hypertension, dyslipidemia, and renal impairment, as well as addressing medication risk–benefit profiles and costs, when making treatment choices [17].

BASAL-BOLUS THERAPY USING INSULIN GLARGINE AND INSULIN LISPRO IN THE MANAGEMENT OF DIABETES MELLITUS

Basal-bolus therapy (BBT) refers to the combination of a long-acting basal insulin with a rapid-acting insulin at mealtimes. Basal insulin glargine 100 U/mL and prandial insulin lispro have been available for many years and there is a substantial evidence base to support the efficacy and safety of these agents when they are used in BBT or basal-plus therapy for patients with type 1 or type 2 diabetes mellitus (T1DM, T2DM). With the growing availability of alternative insulins for use in such regimens, it seems timely to review the data regarding BBT with insulin glargine 100 U/mL and insulin lispro. In patients with T1DM, BBT with insulin glargine plus insulin lispro provides similar or better glycemic control and leads to less nocturnal hypoglycemia compared to BBT using human insulin as the basal and/or prandial component, and generally provides similar glycemic control and rates of severe hypoglycemia to those achieved with insulin lispro administered by continuous subcutaneous insulin infusion (CSII). Studies evaluating BBT with insulin glargine plus insulin lispro in patients with T2DM also demonstrate the efficacy and safety of these insulins. Available data suggest that BBT with insulin glargine and insulin lispro provides similar levels of efficacy and safety in pediatric and adult populations with T1DM and in adult patients and those aged more than 65 years with T2DM. These insulin preparations also appear to be safe and effective for controlling T2DM in people of different ethnicities and in patients with T1DM or T2DM and comorbidities [18].

As the number of people living with type 2 diabetes (T2D) continues to rise, managing their complex needs presents an increasing challenge to physicians. While treatment guidelines provide evidence-based guidance, they are not prescriptive—rather they emphasize individualization of management based on a patient's clinical needs and preferences. Physicians, therefore, need to be fully aware of the advantages and disadvantages of the multiple and increasing treatment options available to them at each stage of the disease. The progressive nature of T2D means that treatment with basal insulin will become inevitable for many patients, while for some patients basal insulin alone will eventually be insufficient for maintaining glycaemic targets. Recent guidelines recommend two basic approaches for intensifying basal insulin: the use of rapid-acting insulin, either as additional prandial injections or as part of premix (biphasic) insulin; and the addition of glucagon-like peptide-1 receptor agonists (GLP-1 RAs) to the insulin therapy, which can be administered via subcutaneous injection once or twice daily, or weekly depending on formulation. More recently, two fixed-ratio combinations of basal insulin and a GLP-1 RA that allow for once-daily dosing have been approved. Each of these approaches has potential benefits and drawbacks, particularly in terms of risk for hypoglycemia, weight change, convenience, and side effects [19].

SAFETY AND EFFICACY OF DPP4 INHIBITOR AND BASAL INSULIN IN TYPE 2 DIABETES

The safety and efficacy of dipeptidyl peptidase-4 (DPP4) inhibitors as monotherapy or in combination with other oral antidiabetic agents or basal insulin are well established. DPP4 inhibitors stimulate glucose-dependent insulin secretion and inhibit glucagon production. As monotherapy, they reduce the hemoglobin A1c level by about 0.6–0.8%. The addition of a DPP4 inhibitor to basal insulin is an attractive option, because they lower both postprandial and fasting plasma glucose concentrations without increasing the risk of hypoglycemia or weight gain. These drugs are highly effective and safe in the elderly and in the presence of mild, moderate and severe renal failure improving glycemic control with low risk of hypoglycemia. In addition, several randomized-controlled trials have shown that the use of DPP4 inhibitors in combination with basal insulin represents an alternative to the basal-bolus insulin regimen in hospitalized patients with type 2 diabetes [20].

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PREVENTION AND MANAGEMENT OF DIABETIC FOOT ULCERS

Diabetic foot ulcers (DFUs) remain a major health care problem. DFUs are complex chronic wounds that have a major long-term impact on the morbidity, mortality and quality of patients' lives. Individuals who develop DFUs are at greater risk of premature death, myocardial infarction and fatal stroke than those without a history of this complication. While national and international guidance exists, the evidence base for much of routine clinical care is thin. It follows that many aspects of the structure and delivery of care are susceptible to the beliefs and opinion of individuals. It is probable that this contributes to the geographic variation in outcome that has been documented in a number of countries. There is strong suggestive evidence to indicate that appropriate changes in the relevant care pathways can result in a prompt improvement in clinical outcomes. Despite considerable advances made over the last 25 years, diabetic foot ulcers (DFUs) continue to present a very considerable health care burden—one that is widely unappreciated. DFUs are common, the median time to healing without surgery is of the order of 12 weeks, and they are associated with a high risk of limb loss through amputation. The 5-year survival following presentation with a new DFU is of the order of only 50–60% and hence worse than that of many common cancers. While there is evidence that mortality is improving with more widespread use of cardiovascular risk reduction, the most recent data—derived from a Veterans Health Adminstration population—reported that 1-, 2-, and 5-year survival was only 81, 69, and 29%, respectively, and the association between mortality and DFU was stronger than that of any macrovascular disease [21].

AMNIOTIC MEMBRANE TREATMENT IN PATIENTS WITH DIABETIC FOOT ULCERS

Moist dressings, debridement, wound offloading and infection control are standard therapy or standard of care (SOC) in the management of DFUs. Processed human amnion/chorion membrane (cryopreserved, dehydrated or acellular) is considered to be an adjunctive wound therapy. Several studies have recently shown its effectiveness in diabetic wound healing. It promotes wound closure, resulting in a more consistent and faster healing of chronic DFUs when compared with standard therapy alone. In fact, many studies have shown human amniotic membrane has properties that enhance healing. The PURION® processed dehydrated human amnion/chorion membrane (dHACM) retains biologically active growth factors and regulatory factors that are in part responsible for its clinical effectiveness in wound healing [22].

STANDARDS OF MEDICAL CARE IN DIABETES

There is currently a worldwide epidemic of type 2 diabetes (T2D) that is predicted to increase substantially in the next few years. With 80% of the global T2D population living in low to middle-income countries, there are issues with cost and of access to appropriate medicines. The objective of this symposium was to provide an overview of the efficacy and safety of glucose-lowering drugs, focussing in particular on sulfonylureas (SUs) in patients with T2D using data taken from both randomised controlled trials (RCTs) and real-world studies, the application of strategies to ensure optimal patient adherence and clinical outcomes, and the optimal use of SUs in terms of dose adjustment and agent choice to ensure the best clinical outcome. The symposium began by exploring a profile of the typical patient seen in diabetes clinical practice and the appropriate management of such a patient in the real world, before moving on to an overview of the risks associated with T2D and how the currently available agents, including newer antidiabetic medications, mitigate or exacerbate those risks. The final presentation provided an overview of real-world studies, the gap between RCTs and the real world, and the use of available glucose-lowering agents in daily clinical practice. Clinical evidence was presented demonstrating that tight glucose control improved both microvascular and macrovascular outcomes, but that aggressive treatment in patients with a very high cardiovascular risk could lead to adverse outcomes. Real-world data suggest that older agents such as SUs and metformin are being used in a large proportion of patients with T2D with demonstrable effectiveness, indicating that they still have a place in modern T2D management. The symposium, while acknowledging the need for newer antidiabetic drugs in specific situations and patient groups, recommended the continuation of SUs and metformin as the primary oral antidiabetic agents in resource-constrained regions of the world [23].

While lifestyle modifications and metformin are the cornerstone of the initial management of T2DM, there is an increasing array of second and third-line pharmacological agents for this condition. At present there are different families of oral and injectable drugs, available for the treatment of T2DM. Moreover, insulin analogues that better simulate endogenous insulin secretion have been developed. Metformin remains the

first choice of treatment for most patients. Other alternative or second-line treatment options should be individualized taking into consideration patient characteristics as degree of hyperglycaemia, presence of co-morbidities, and patient preference and ability to access treatments; and properties of the treatment such effectiveness and durability of lowering blood glucose, risk of hypoglycaemia, effectiveness in reducing diabetes complications, effect on body weight, side effects and contraindications. Although it does not appear that in the near future cure diabetes, novel safety and effective agents that will improve the quality of life of T2DM patients, are developing [24].

The Professional Practice Committee (PPC) of the American Diabetes Association (ADA) is responsible for the "Standards of Medical Care in Diabetes," referred to as the Standards of Care. The PPC is a multidisciplinary expert committee comprised of physicians, diabetes educators, and others who have expertise in a range of areas, including adult and pediatric endocrinology, epidemiology, public health, lipid research, hypertension, preconception planning, and pregnancy care. Appointment to the PPC is based on excellence in clinical practice and research. Although the primary role of the PPC is to review and update the standards of care, it may also be involved in ADA statements, reports, and reviews.

The ADA adheres to the national academy of medicine standards for developing trustworthy clinical practice guidelines. All members of the PPC are required to disclose potential conflicts of interest with industry and/or other relevant organizations. These disclosures are discussed at the onset of each standards of care revision meeting. The ADA funds development of the standards of care out of its general revenues and does not use industry support for this purpose [25].

CONCLUSION

New drugs are developing to treat diabetes and these important roles have a great impact on the prevention and management of this disease which improves patient's quality of life. A community-based public health intervention addressing nutrition and exercise can improve disease control and health perception in diabetic patients. Delivering effective dietary advice for people with diabetes goes beyond supplying information and addresses the behavioural and psychosocial determinants of health behaviour change.

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