In Brief

Clinicians who manage older people with diabetes require special skills if they wish to provide high-quality care. Their approach is influenced by a multitude of factors, such as the higher frequency of medical comorbidities, frailty, and socioeconomic issues. Comprehensive geriatric assessment is a potentially important tool in ensuring that patients with diabetes receive a multiprofessional assessment of their functional status and unmet needs. Effective goal setting provides an additional means of confirming that therapeutic approaches are on target.

Special Considerations in Older Adults With Diabetes: Meeting the Challenge

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Older adults do not accept illness without question and expect to have the same access to treatment and services as younger people. In most westernized societies, older people are a significant proportion of the voting public and as such can be very persuasive in ensuring that there are political commitments to improving the organization and delivery of health care. At the same time, the medical profession must honor its own commitment to strive for excellence in medical care, and diabetes poses one of the greatest challenges in this arena.

Thoroughness and vigilance are prime qualities that are needed in managing older adults with diabetes, especially in the areas of assessment and treatment. This may be particularly important in older patients with diabetes who may have considerable (but often undetected) impaired lower-extremity function, cognitive dysfunction, or depression. In addition, we need to stimulate the interest of clinical and laboratory researchers to provide us with the evidence to justify particular therapeutic interventions and to promote specific patterns of care characterized by three themes: a major emphasis on quality of life and well-being for each patient, early and effective interventions, and a commitment to improving or maintaining functional status.

Acquiring unique knowledge and skills in geriatric diabetes enhances diabetes care for the vulnerable directly and, often, indirectly by influencing attitudes (avoiding ageism and a reductionist approach) to care. This article focuses on the principles of diabetes care, functional impairment, a brief discussion of cognitive performance and depressive disorder, and hypoglycemia and concludes with appropriate goal setting. Discussions relating to diabetes care in nursing homes, specific treatment strategies, and cardiovascular risk will not be included.

Principles of Diabetes Care

There are certain generic principles in diabetes care that, one assumes, we all subscribe to and aims that are particularly applicable to the elderly. These have been amalgamated and represented in Table 1.[1] These principles form a template for diabetes care. However, other factors influence management in individual cases, and these have been represented in Table 2.[2] It should be remembered that these issues are inseparable for those wishing to deliver integrated high-level diabetes care. This approach will have its rewards, although you must realize that in managing older people, small gains are the norm. Still, despite being small, these gains often have a considerable impact on well-being.

Table 1. Major Aims in Managing Older Adults With Diabetes

Medical	Patient Oriented
• Freedom from hyperglycemic symptoms	• Maintenance of general well-being and good quality of life
• Prevention of undesirable weight loss	• Acquisition of skills and knowledge to adapt to lifestyle changes
• Avoidance of hypoglycemia and other adverse drug reactions	• Encouragement of diabetes self-care
• Estimation of cardiovascular risk as part of screening for and preventing vascular complications	
• Detection of cognitive impairment and depression and functional disabilities at an early stage	
• Achievement of a normal life expectancy for patients where possible	

Functional Impairment in Diabetes and the Role of Comprehensive Geriatric Assessment

Diabetes is associated with both functional impairment and disability. The wide spectrum of vascular complications, acute metabolic decompensation, adverse effects of medication, and the effects of the condition on nutrition and lifestyle behavior may all create varying levels of impairment and/or disability. These changes may have adverse rebound effects on vulnerability to other comorbidities, independence, and quality of life. Advancing age itself, even in the absence of specific diagnosed conditions, is associated with disability, suggesting that disease prevention or amelioration would only be partially effective.

Although in a Framingham cohort study[3] of subjects with a mean age of 74 ± 6 years, diabetes was ranked below stroke, depression, hip fracture, heart disease, osteoarthritis, and chronic respiratory disease in causing functional limitation, the Health and Retirement Survey[4] (> 6,300 subjects aged 51–61 years at baseline) identified diabetes as an important predictor of failing to recover from a mobility difficulty over a 2-year follow-up period. In a systematic literature review of longitudinal studies examining the relationships between various risk factors and functional status outcomes,[5] diabetes was one of five conditions (others were hypertension, stroke, transient ischemic attack, and arthritis) for which there were ≥ 10 studies showing a significant association between the risk factor and subsequent functional decline.

Table 2. Factors That May Influence a Clinician's Approach to Managing Older Patients With Type 2 Diabetes

- Poorer socioeconomic situation
- Greater social isolation and loneliness
- Higher frequency of depressive illness or cognitive impairment
- Nursing home residency
- Greater reliance on informal or formal caregivers
- Polypharmacy
- Frailty and limited life expectancy
- Significant comorbidities that limit ability to self-medicate and recognize or deal with hypoglycemia

The Welsh Community Diabetes Study[6] funded by the U.K. Department of Health was one of the largest case-control studies of diabetes in the world but has attracted little attention from those responsible for initiating organizational change in diabetes in the United Kingdom. This study recognized at an early stage the considerable impact of diabetes on both physical and cognitive function in aging subjects (mean age 75 years), with significant detriments in activities of daily living (ADLs), extended ADLs (which includes assessment of domestic/social activities), cognitive screening tests, and quality of life. Compared with control subjects, the relative risk of a patient with diabetes having peripheral vascular disease was nearly twofold higher (odds ratio [OR] 1.92, 95% CI 1.52–2.44, $P < 0.0001$). Diabetes has subsequently been confirmed as one of three chronic disorders (along with cerebrovascular disease and anxiety/depression) most clearly related to disability in a large survey of community-dwelling subjects aged ≥ 65 years living in Madrid.[7]

Each disability has the potential to disadvantage (handicap) individuals considerably, such as failure to enjoy outside entertainment and leisure activities and inability to go shopping. Handicap is not an inevitable occurrence because many factors such as the reversibility of the intrinsic impairment, presence of other medical comorbidities, mood, and even social support and financial status can have dramatic effects on the level of impact of the disability. Specific rehabilitation programs for diabetes-related disability require justification, and clinicians managing older patients require detailed knowledge of assessment, available therapies via the multidisciplinary environment, goal-setting strategies, a realistic time frame for rehabilitation, and what aids and appliances are available.

In a similar manner to educational programs, encouraging patients to take an active part in rehabilitation can foster their autonomy, improve their self-esteem and coping skills, and reduce their anxiety and depression. The recent work of Gregg et al.[8] and Volpato et al.[9] takes us forward to understanding the nature of the disabling process and is paving the way for reablement (perhaps enablement might be a better word) in diabetes. Although the multifactorial nature of this process may prevent straightforward interventions from being effective, we do need a greater understanding of the role of glycemic control. Because depression has also been suggested to be the most important determinant of admission to a hospital in older patients with diabetes, and recognition and treatment of depression can also lead to improved glycemia in diabetes,[10] this area of inquiry becomes rather exciting.

Falls and fall-related fractures are a source of enormous morbidity and resultant disability. In those > 65 years of age, falls are the most common cause of injury and hospital admission for trauma and may account for > 80% of fractures. In people with diabetes, the increased risk of falling is nearly threefold, and diabetic patients have a twofold increase in the risk of having a fall

that is injurious,[8] with fall-related fractures being more common in women. Factors contributing to falls include problems with gait and balance as well as neurological and musculoskeletal disabilities. In addition, in people with diabetes, the high rate of cardiovascular disability, visual deficit, cognitive impairment, and treatment-related issues are likely to be contributory. For example, in the Study of Osteoporotic Fractures,[11] insulin treatment increased significantly the risk of falling in older women with diabetes; factors that may be implicated are the duration and severity of the diabetes or possibly a higher rate of hypoglycemia. Clinicians involved in managing older people with diabetes must directly question patients about the occurrence of falls and provide an estimate of risk.

It is also important to identify patients who would appropriately be labeled as frail because the aims of care are modified for such patients. Frailty in this context represents a vulnerability to a wide range of adverse outcomes secondary to the effects of aging, long-term vascular complications of diabetes, physical and cognitive decline, and the presence of other medical comorbidities. In the frailty model of diabetes,[12] a framework is developed that provides further assistance with clinical decisions. This allows health professionals to define a series of factors, such as recurrent hypoglycemia, cardiac disease, and reduced recovery from metabolic decompensation, that have three characteristics in common:

- They may represent a precursor state to disability
- They are often a direct threat to independence
- They may have preventable or reversible components.

The annual review process should now include an assessment of basic measures of ADL function, such as a Barthel test; tests of cognitive function, such as the Mini-Mental State Examination (MMSE) or Clock Test; a screen for depression, such as the Geriatric Depression Score; and an assessment of gait and balance, which can be simply estimated by the timed "Get Up and Go" test. This involves asking the patient to stand from a chair that has armrests, walk 3 meters, turn, walk back to the chair, and sit down. If this takes longer than 30 seconds, there is evidence of impaired mobility. Patients with major mobility and/or falls disorder require referral to a local therapy center where physical therapy and occupational therapy are available or to a geriatrician, preferably one who has an interest in diabetes and falls disorder. This integrated process of assessment, which we call comprehensive geriatric assessment, is suitably applied to diabetes in Table 3.[13]

Diabetes and Cognitive Performance

Impaired cognitive function has been demonstrated in older patients with type 2 diabetes. Various community-based studies have shown worse cognitive function in elderly diabetic subjects using simple tests such as the Folstein MMSE, an Abbreviated Mental Score, and the Clock Test. A recent prospective cohort study involving 682 women with self-reported diabetes (mean age population sample 72 years) followed up for 6 years indicated a twofold increased risk of cognitive impairment and a 74% increase in cognitive decline compared with age-related subjects without diabetes.[14] Women with diabetes of > 15 years' duration had a threefold increase of cognitive impairment at baseline and a doubling of the risk of decline. In the Framingham Study,[15] type 2 diabetes and hypertension were found to be significant but independent risk factors for poor cognitive performance on tests of visual organization and memory in a large prospective cohort sample followed for > 20 years.

Impaired cognitive function may result in poorer adherence to treatment, worsen glycemic control because of erratic diet and medication use, and increase the risk of hypoglycemia if patients forget that they have taken their hypoglycemic medication and repeat the dose. There may be several benefits from the early recognition of cognitive impairment in older people with diabetes, which emphasizes the importance of including tests of cognition in the functional assessment of all older patients. Depending on its severity, cognitive dysfunction in older diabetic patients may remain undiagnosed and have considerable implications that include increased hospitalization, less ability for self-care, less likelihood of specialist follow-up, and increased risk of institutionalization.[16] Clinicians must be prepared to refer patients for specialist assessment if memory loss or behavior change becomes an issue. Looking for these deficits is imperative.

Table 3. Criteria for Targeting Patients With Type 2 Diabetes for Comprehensive Geriatric Assessment

- Presence of a geriatric syndrome: confused state, depression, falls, incontinence, immobility, pressure sores
- Presence of several coexisting morbidities, apart from diabetes, with complex drug regimens
- Presence of disabilities resulting from lower-limb vascular disease or neuropathy requiring a rehabilitation program in the absence of a terminal illness or dementing syndrome

Depression and Diabetes

Depression occurs in up to one-fourth of patients with cardiovascular disease and diabetes, and in both cases, clinical outcomes are worse.[17] Depressed patients with heart disease have an increased risk of reinfarction and all-cause mortality, while patients with diabetes and depression have poorer glycemic control, more diabetes symptoms, and greater all-cause mortality.

Because depression is associated with both biological (hypothalamic-pituitary-adrenal axis dysfunction) and psychosocial (adherence, poorer diet, and exercise) processes, further adverse medical outcomes in patients with diabetes are not uncommon.

Diabetes was significantly associated with depression independent of age, sex, or presence of chronic disease in one study,[18] while in another, the presence of diabetes appeared to double the odds of developing depression.[19] The finding of depression was the single most important indicator of subsequent death in a group of diabetic patients admitted to the hospital.[20]

Failure to recognize depression can be serious because it is a long-term, life-threatening, disabling illness and has a significant impact on quality of life.[21] Depression may be associated with worsening diabetic control and decreased treatment compliance.[22] More recently, a 3-year follow-up study of newly diagnosed patients with type 2 diabetes showed significant differences in depressed subjects, who were more likely to modify or discontinue their oral hypoglycemic agent, thereby increasing the risk of adverse

metabolic outcomes.[23] In the Baltimore Epidemiologic Project,[24] a 13-year follow-up of > 3,400 household residents (~ 1 in 7 was ≥ 65 years of age), major depressive disorder had an adjusted OR of 2.23 for predicting the onset of type 2 diabetes.[24]

As a consequence of these findings, it is imperative that clinicians review patients' depressive symptoms and that goal setting and future management may need to involve psychogeriatric input. The benefits of antidepressant therapy appear to be similar in both diabetic and nondiabetic patients, but further research on how treatment affects outcomes overall is warranted.

Hypoglycemia

In older patients, susceptibility to hypoglycemia is pronounced, and this is exacerbated by older people having little knowledge about the symptoms and signs of hypoglycemia. The presenting symptoms of hypoglycemia in older adults can be primarily neuroglycopenic (confusion, delirium, dizziness) rather than adrenergic (palpitation, sweating, tremors). Indeed, health professionals may misdiagnose hypoglycemia as a stroke, transient ischemic attack, unexplained confusion, or epileptic fit.

Patients with cognitive impairment and those with loss of the warning symptoms of hypoglycemia are vulnerable because they may not recognize impending hypoglycemia or may fail to communicate their feelings to their caregivers. Multiple risk factors underlie the increased susceptibility to hypoglycemia in the elderly, and these include recent discharge from the hospital with a recent change in sulfonylurea, renal and hepatic impairment, excess alcohol, and insulin therapy.[25] In addition, older patients mount a diminished counterregulatory response to hypoglycemia,[26] and this may lead to a delay in recovery.

Elderly patients are often incapable of treating hypoglycemia themselves, and therefore educational programs should include advice and information relating to the detection and treatment of hypoglycemia, including the criteria for admission in cases of unresponsive hypoglycemia. An important clinical problem for older patients taking sulfonylureas is prolonged hypoglycemia, especially when many older people have little knowledge of the symptoms of hypoglycemia.

Glyburide-induced hypoglycemia may be more pronounced because the drug accumulates within β-cells, and its metabolites retain some hypoglycemic activity. In the presence of impaired renal function, further prolongation of hypoglycemia occurs. Gliclazide, glipizide, and tolbutamide are less likely to cause hypoglycemia. It should be remembered that insulin therapy carries a greater risk of hypoglycemia than sulfonylurea therapy, but the introduction of insulin analogs may decrease this risk. Newer oral agents, such as the thiazolidinediones and the meglitinides, may also lower the risk of hypoglycemia in the elderly.

Serious hypoglycemia appears to have a worse prognosis in older patients, with high mortality following hospital admission; some may have permanent neurological damage, presumably because of an already compromised cerebral circulation. Most sulfonylureas have caused fatal hypoglycemia, although this is often associated with chlorpropamide or glibenclamide (glyburide). Other factors apart from old age that predispose to fatal hypoglycemia are alcohol consumption, poor food intake, renal impairment, potentiation of hypoglycemia by other drugs, and prescription of sulfonylureas. Many, if not all, of these factors are directly relevant in elderly patients with type 2 diabetes.

Effective Diabetes Care for Older Adults: Importance of Goal Setting

Modern diabetes care systems for older people require integrated care between general practitioners, hospital specialists (diabetologists and geriatricians), and other members of the health care team. This should have a multidimensional approach with an emphasis on prevention of diabetes and its complications; early intervention for vascular disease; assessment of disability because of limb problems; assessment of other geriatric syndromes, eye disease, and stroke; and an overall strategy to promote well-being and normal life expectancy.

While managing diabetes in older adults, clinicians must be aware of some important differences from younger patients that should influence their approach in management (Table 2). An initial plan of management is presented in Table 4. In addition, a therapeutic summary to promote successful aging for older people with diabetes is presented in Table 5. Metabolic targets are in general those of the European Diabetes Working Party for Older People.[27]

The components of a modern-day geriatric diabetes service are based on the concept of a multidimensional intervention model[1,12] and emphasize the importance of early intervention in

Table 4. Care Plan for Initial Management of Diabetes in an Elderly Person

1. Establish realistic glycemic and blood pressure targets.
2. Ensure consensus with patient, spouse, or family; general practitioner; informal caregiver; community nurse; or hospital specialist.
3. Define the frequency and nature of diabetes follow-up.
4. Organize glycemic monitoring by patient or caregiver.
5. Refer to social or community services as necessary.
6. Provide advice on stopping smoking, increasing exercise, and reducing alcohol intake.

Table 5. Successful Aging With Type 2 Diabetes: A Patient's Guide to Goal Setting

- Participate in educational approaches to a healthy lifestyle and exercise.
- Take aspirin, 75–81 mg daily, unless contraindicated.
- Take a statin unless your total cholesterol is < 152 mg/dl.
- Achieve a blood pressure of < 140/80 mmHg.
- Have your hemoglobin A_{1c} (A1C) measured at least every 6 months.
- Aim for an A1C of 6.5–7.5% based on your risk of micro- and macrovascular complications. A lower target A1C is preferred if you have evidence of macrovascular disease.
- Agree on a higher target A1C if you are at risk of iatrogenic hypoglycemia.
- Participate actively in structured care with empowerment that includes regular assessment of function, cognition, and mood, with review of treatment goals.

vascular disease (retinal, microvascular, and macrovascular) and establishing rehabilitation programs for patients with a wide variety of disabling complications (e.g., amputation, peripheral neuropathy, immobility, falls, stroke, and cognitive change). Critical event monitoring is an integral part of this model and represents a system of monitoring those critical periods of ill health or social care need where patient vulnerability is high and opportunity for intervention is paramount (e.g., admission to the hospital, amputation, or stroke illness).

Conclusion

Ensuring cost-effective care is increasingly important in our health care system. Diabetes, in view of its high prevalence, long duration of impact, wide spectrum of complications, and emotional and psychological sequelae, provides a complex case for cost-effective studies. In older patients, this is even more complex because of many other confounding factors. Two studies published nearly a decade ago[28,29] suggested that aggressive treatment of diabetes in older individuals was not warranted because of reduced life expectancy. However, as diabetes care systems have moved on and become more integrated and large-scale clinical studies are demonstrating benefits in metabolic intervention in older patients, these conclusions may not be justified. Implementing some of the strategies outlined above may lead to reduced acute hospitalization, lower outpatient costs, and less long-term disability. Only well-organized prospective clinical trials will be able to answer this important research question.

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