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Review article

Diabetes in the elderly – a neglected area?

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The need for physicians with special interest in diseases of old people has been questioned because it is said that the old suffer from the same illnesses as the middle aged. By the same token, it could be argued that there is nothing special about diabetes in old people and hence the relative lack of articles on this subject is justified. Text books of diabetes always have chapters on the special situations of childhood and pregnancy but, for example, the latest edition of Ellenberg and Rifkin [1] and the World Book of Diabetes in Practice [2] have no chapter on diabetes in the elderly, nor any reference to it in the index. It is true that most aspects of the subject are covered in these books, but they are not drawn together so that a reader can locate them conveniently.

I believe this lack of publications reflects neglect by diabetologists of a large and disproportionately important segment of the diabetic population – those over 65 years old make up 15% of our population and those over 75 years 6%. Looked at in another way, two-thirds of diabetic patients in hospital in the United Kingdom are over 65 years old [3]. Perusal of the programme of almost any international meeting makes it clear that diabetic specialists have decided to concentrate their efforts on young insulin-dependent patients where they can "do most good". The result is that the elderly are often denied specialist care and left to fend for themselves until a crisis occurs. The purpose of this article is to suggest that management of diabetes in the elderly is difficult and challenging and worthy of the attention of diabetologists.

Diagnostic criteria and diagnosis

On average there is a progressive deterioration of performance, decade by decade, in all commonly used diagnostic tests for diabetes [4]. The average 2-h plasma glucose in a glucose tolerance test rises by approximately 0.5 mmol/l per decade after 50 years of age [5] and the fasting level by 0.06 mmol/l [6]. One could argue (and many have!) whether this represents an increasing emergence of diabetes with age or whether it is a physiological change, perhaps in response to declining cerebral blood flow. Aside from these metaphysical arguments, the practical consequence of defining normality on the basis of standards derived from the young is that up to 50% of 'healthy' old people used to be at risk of being labelled 'diabetic' if they had a glucose tolerance test. For example, in a Canadian old people's home where the average age of residents was 82 years, regular screening led to 32% being reclassified from normal to diabetic over a 3-year period [7]. Only 6.5% of these old people had a random blood glucose over 11.1 mmol/l and most would now be regarded as having impaired glucose tolerance. The creation of a category of impaired glucose tolerance between normality and diabetes [8, 9] has to a certain extent rectified the over-diagnosis of diabetes in the old. Nevertheless, I suggest that when making a diagnosis of diabetes in old people we should not be bound rigidly by official definitions but should ask ourselves whether labelling the individual as 'diabetic' will do more good than harm. For example, an 80-year-old lady, whose average blood glucose after a stroke is 11 mmol/l, may have her declining years made needlessly miserable by a diabetic diet which is rigidly enforced by the staff of the old people's home. At the other end of the spectrum there would be considerable benefit if the finding of asymptomatic glycosuria led to the discovery of maculopathy and preservation of useful vision by photocoagulation.

Is diabetes in the elderly mild or severe?

The severity of a disease is judged by its consequences and, by this yardstick, it is apparent that diabetes is an important cause of morbidity and mortality in old people. Official mortality statistics derived from death certificates may underestimate the effects of diabetes by four- or fivefold [10]. In a large cohort study of Type 2 (non-insulin-dependent) diabetes [11], 44% of patients had died within 10 years of diagnosis. The 10-year mor-

Fig. 1. Example of a problem list for a newly diagnosed elderly diabetic patient, aged 76 years: an exercise in applied pharmacology

	Diabetes-related problems		*Other problems*
1983	Type 2 diabetes. Symptomatic onset (fasting blood glucose 16.8 mmol/l)	1973	Cholecystectomy
		1976	Hypertension
1983	Maculopathy (visual acuity: right eye 6/36, left eye 6/18)	1980	Osteoarthritis of knees
		1981	Atrial fibrillation
1983	Peripheral neuropathy with foot deformities	1981	Temporal arteritis
		1982	Gastrointestinal bleeding due to duodenal ulcer
		1983	Widow. Lives alone

Drugs	
Propranolol	80 mg 3 × daily
Bendrofluazide	5 mg daily
Prednisolone	2.5 mg 3 × daily
Indomethacin	75 mg nocte
Digoxin	0.25 mg daily
Aspirin	As required
Cimetidine	400 mg at night

tality rates in the age groups 40–49, 50–59, 60–69 and 70–79 years were 12%, 26%, 51% and 81% respectively. Nevertheless, the excess mortality in the diabetic group declined with increasing age at diagnosis so that those diagnosed aged 75 years or more fared no different from the general population. The major cause of death in elderly diabetic patients was macrovascular disease, for which there are likely to be many risk factors other than hyperglycaemia (for example obesity and hypertension). A priori it seems improbable that reducing blood glucose concentrations in a 65-year-old will reverse or halt the progession of macrovascular disease, and hence one possible conclusion is that the main aim of treatment in the newly diagnosed elderly person with diabetes should be to avoid causing iatrogenic problems.

The excess mortality of the elderly diabetic may not differ from that of the general population, but the morbidity in this age group is high and the demand made on in-patient hospital services disproportionate. Two-thirds of diabetic patients in hospital are 65 years or older and have been admitted with either atherosclerotic disease or foot problems [3]. More than 2% of acute medical beds in the Nottingham hospitals, serving a population of 750,000, are occupied constantly by diabetic patients with an average age of more than 70 years who have a foot problem. More than half of all non-traumatic amputations are carried out on diabetic patients, usually the elderly [12, 13], and gangrene in the seventh decade is over 50 times more common in the diabetic [14]. Diabetes figures prominently as a cause of blindness although official figures probably under-estimate its frequency, especially in elderly women [15]. Peripheral neuropathy, peripheral vascular disease, and maculopathy are probably irreversible, even with perfect blood glucose control, although their worst consequences, foot ulcers, gangrene and blindness, can often be prevented by foot care and photocoagulation. Therefore, one of the major aims of treatment of diabetes in the elderly should be good general medical care rather than exclusive concentration on the levels of blood glucose.

Assessment and treatment of the elderly diabetic

In many ways the elderly patient with newly diagnosed diabetes is more difficult and time-consuming to assess than is the young counterpart. In the case of the young person, diabetes is the only problem and its treatment will cure all the symptoms. By contrast, the glycosuria of the old person may be irrelevant to the presenting symptoms. For example, it is not uncommon to find old people referred to a diabetic clinic with glycosuria when urinary symptoms are due to an enlarged prostate, pruritus vulvae to atrophic vaginitis and tiredness to anaemia or hypothyroidism. A careful clinical examination is necessary to ensure appropriate treatment. Blood glucose control may be less important than the fact that the patient already has complications at diagnosis; a fifth or more of newly diagnosed elderly diabetics will already have retinopathy [16], and more will have symptomatic macrovascular disease. Many will also have other ailments unrelated to and possibly of more immediate importance than diabetes. The older the patient, the more important is a comprehensive problem list (Fig. 1) to assign priorities and ensure that the diabetic regimen does not conflict with other medications. Many

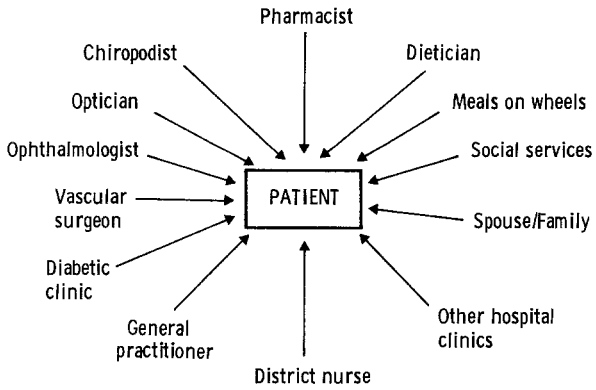

Fig. 2. The many agencies which may be involved in the care of the elderly diabetic in a welfare state. Someone must be in overall charge to ensure that advice and treatment from different sources do not conflict

agencies are likely to become involved in the treatment of the elderly diabetic (Fig. 2) and it is important to identify someone who will be in overall control.

The keynote of treatment should be simplicity. One should aim for symptom relief with blood glucose control as good as necessary without interfering with enjoyment of life. If complications are already present, prophylactic treatment to prevent them worsening is the most important objective.

Diet

Most symptomatic, elderly, diabetic patients can be satisfactorily controlled on a simple diet which emphasises elimination of sucrose and reduction in total energy intake [17]. The introduction of foods high in natural fibre also appears effective and well tolerated by old people in institutions [18]. However, the main problem with the elderly is not to define an effective diet but to teach it, especially to those who live alone. Changing the eating habits of 60 or 70 years is a formidable problem made more difficult because old people are not used to learning and often have poor memories. Many diets for the elderly are unnecessarily rigid and complicated and I agree with Wilson et al. [17] that a school room approach or trying to teach dietary theory is doomed to failure. A visit to the home or larder by a nurse or dietician who adopts a strictly practical approach is much more likely to succeed. Rather than giving the patient a diet sheet it may be just as effective to emphasise total calorie restriction by saying "eat half of what you used to".

Oral hypoglycaemic agents

Tablets are deceptively easy to prescribe and, faced with the difficulty of implementing diet in the aged, many doctors simply prescribe a sulphonylurea with the aim of relieving symptoms. This is not only unnecessary in that a simple diet will usually relieve symptoms within 2 or 3 weeks, but may also be dangerous; the patient is already likely to be taking several other drugs. In Grobin's study of old people in institutions [7], 60% of non-diabetic and 66% of diabetic patients were already taking three or more drugs daily. Logie et al. [19] found that two-thirds of 709 Type 2 diabetic subjects in Aberdeen were each taking between one and nine additional prescribed medicines, and half were exposed to drugs with a potential to interact with their anti-diabetic treatment. Adding yet another drug may lead to either iatrogenic disease or confusion and non-compliance.

The other main worry is the danger of hypoglycaemia. Earlier studies [20, 21] suggested that chlorpropamide was particularly dangerous in the elderly because of its long half-life and tendency to cause insidious hypoglycaemia during the night. This type of hypoglycaemia, especially when it presents as confusion, hemiplegia or unconsciousness, is particularly dangerous not only because it is difficult to reverse, but also because it may be misdiagnosed as cerebrovascular disease. With the introduction of glibenclamide, which has a relatively short biological half-life, it was thought that hypoglycaemia in the elderly would be less common and less severe. This is probably incorrect. In a recent study in Sweden [22], the median age of those who became hypoglycaemic on glibenclamide was 70 years against an average of 75 years for all patients on the drug. Hypoglycaemia appeared to be particularly common and dangerous in those over 85 years of age who made up 21% of the total. Hypoglycaemia was often protracted (lasting up to 3 days) and death could and did occur on doses as small as 2.5 mg daily.

Some factors leading to hypoglycaemia in patients on sulphonylureas are predictable, for example potentiation of the effect of chlorpropamide by impaired glomerular-filtration or by the concomitant use of sulphonamides, salicylates or phenylbutazone. What is not predictable is the appearance of intercurrent illness which may cause the old person to "go off their food". The only safe rules are to prescribe sulphonylureas as sparingly as possible in the old and always to start off with a minimum dose (chlorpropamide 50 mg or glibenclamide 2.5 mg daily).

Insulin treatment

The incidence of ketosis-prone insulin-dependent diabetes after the age of 65 years is unknown. When it does occur the diagnosis is often made late, as in the following case:

A 67-year-old man (height 163 cm, weight 46 kg) was seen by his general practitioner with a 2-week history of thirst, weight loss, polyuria and dysphagia. His urine was loaded with sugar but was not tested for ketones. He was advised to avoid sugar, started on gliben-

clamide 5 mg daily and given an appointment for the diabetic clinic in 1 week. A day before he was due to attend the clinic a neighbour broke in and found him semi-conscious lying on the floor. On admission to hospital, he was seriously ill with a blood glucose of 52.3 mmol/l and a bicarbonate of 8 mmol/l. This man was an HLA-DR3/DR4 heterozygote and was also islet-cell-antibody-positive. Six months after diagnosis he was well controlled on twice-daily isophane insulin (total dose 14 units) with a haemoglobin A_1 of 5.2%.

In my experience, the stereotype of 'mild' Type 2 diabetes in the elderly not infrequently leads general practitioners and even diabetologists to overlook severe diabetes in the elderly. What proportion of old people with diabetes need insulin is unknown, but it is worth noting that in Nottingham [23] more than one-third of all episodes of severely uncontrolled diabetes (ketoacidosis and hyperosmolar coma) occurred in patients over 50 years of age. Their mortality was 43% compared with only 3.4% in those under 50 years old. The high mortality is partly accounted for by associated disease (56%), but in the remainder late diagnosis resulted in the patients being so ill when they reached hospital that death was inevitable. Others have also found that age has an adverse effect on the prognosis in diabetic ketoacidosis and have concluded that older patients die because they are more ill, both biochemically and clinically [24].

The indications for putting old people on insulin treatment are the same as at other ages and include ketonuria, persistent symptoms or persistent weight loss while on maximum doses of tablets. The decision should not be taken lightly, although I think it is often delayed too long because of a fatalistic view that old people cannot manage injections. Certainly, there may be problems if the patient lives alone and has shaky hands or poor eye sight, but these can often be overcome either by getting a relative or neighbour to draw up and inject the insulin, or by arranging for a visiting nurse to prefill one week's worth of plastic syringes and store them in the refrigerator.

The aim of insulin treatment in elderly patients should be to make them feel better and avoid hypoglycaemia. The latter is particularly important because hypoglycaemia will discourage the patient as well as those who care for him, and it may also be difficult to diagnose, being confused with postural hypotension, vertebro-basilar insufficiency, transient ischaemic attacks or "ordinary" confusion. It is also often suggested that the increased vulnerability of the vascular system of the elderly may lead to strokes or myocardial infarctions being precipitated by hypoglycaemia, although I know of no evidence that this is true.

Many authorities advocate starting with a single daily dose of intermediate-acting insulin (either lente or isophane) [25, 26]. Unfortunately, this simple regimen is often unsatisfactory both in failing to control fasting hyperglycaemia and also in causing hypoglycaemia either in the late afternoon or during the night. The increasing purity of insulin preparations may have exacerbated the problem by removing the antibodies which act as a 'buffer' to maintain free insulin levels, albeit unphysiologically [27]. In my view, the main reason for using highly purified insulin in the elderly is the expectation that insulin treatment is only going to be temporary – stopping and restarting impure beef insulins is a certain prescription for allergy, anaphylaxis and immunological insulin resistance. The relative lack of success of once-daily insulin in the elderly is indicated by a survey in our clinic in 1977; we identified 32 patients over 65 years old and found that 44% of those on either lente or protamine zinc insulin had had to be changed to a twice-daily regimen because of hypoglycaemia at night (unpublished observations). If there are problems with a once-daily regimen, then a change to twice-daily, intermediate-acting insulin (isophane or equivalent) is usually more satisfactory in avoiding hypoglycaemia. To expect old people to mix soluble and isophane insulins is not only unnecessary but usually causes more problems than it solves.

Monitoring control

Old people often leave the clinic with a urine-testing kit and instructions to test two or three times a day. Not only is urine testing often misleading because of the high renal threshold in old age, but it is often rather pointless since, even if he has glycosuria, the patient neither understands what to do nor has room for manoeuvre except by reducing his food intake. For many old people self-monitoring is an unnecessary chore and it is more cost effective to check control with a monthly fasting blood glucose and body weight [28]. An alternative is to test the urine weekly before and one hour after Sunday lunch [29]. Home blood glucose monitoring by elderly patients themselves is rarely practical or necessary, although it may be valuable to teach the technique to a relative so that they can detect hypoglycaemia.

Complications

Retinopathy

A major advance in the treatment of diabetic eye disease in the past decade has been proof of the long-term effectiveness of photocoagulation in preventing deterioration of visual acuity in patients with maculopathy [30, 31]. This is predominantly a disease of the elderly diabetic and, provided that treatment is given when acuity is 6/36 or better, one can expect preservation of acuity of two lines on the Snellen chart after 5 years. This may mean the difference between being able to live independently and needing to be institutionalised. Treatment is clearly highly cost-effective in that it costs

about £170 (approximately $280), compared with £2871 (approximately $4311) a year to maintain someone who is blind from diabetic retinopathy [32].

The fact that photocoagulation is most effective in maculopathy when visual acuity is 6/12 or better puts the physician under an obligation to detect retinopathy early. This poses a formidable problem and it has been estimated that in the United Kingdom many patients with retinopathy either remain undetected or present too late for effective treatment [32]. At its simplest, screening should consist of yearly measurement of corrected visual acuity in each eye with examination of the macula through dilated pupils. The risk of precipitating glaucoma is greatly reduced, if not abolished, by using tropicamide rather than cyclopentolate as a mydriatic [33]. Such screening is relatively easy in a diabetic clinic but, at least in the United Kingdom, most elderly diabetic subjects are looked after by general practitioners who may lack expertise with an ophthalmoscope.

The elderly diabetic with visual disability needs specialist assessment since other eye diseases are so prevalent that they may well co-exist with or be more important than retinopathy. In the Framingham eye study [34] the prevalence of diabetic retinopathy in a total population aged 75–85 years was 7%, compared with 46% for senile cataracts, 28% for macular degeneration and 7% for glaucoma in the same age group. Even if the eyesight of an old person is threatened only by retinopathy, such patients should have a full general medical examination before being referred for photocoagulation since many will not live long enough to reap its benefits.

Feet

The elderly diabetic is often divorced from his feet, unable to see them because of poor eye sight, unable to feel them because of sensory loss and unable to bend down to touch them because of arthritis [29]. It is true to say that diabetic foot lesions should be prevented, not cured; it has been clear for many years that the incidence of gangrene is much higher among those who have the worst health care and that the most meticulous precautions are necessary to prevent minor injuries in the elderly leading to gangrene. As Joslin [35] put it, "it may seem a detail to tell the patients to wipe their feet gently, but if you wish to avoid gangrene you must enter into all these minutiae". These are things which it is easier to preach about than to achieve since their implementation depends on well-developed support and medical services for the elderly, which are conspicuous by their absence in many areas.

An established foot lesion in an old person leads to many difficult management decisions: what are the chances of healing it conservatively? When should one amputate and at what level? Is it reasonable to expect the patient to walk again with an artificial limb? If the lesion is predominantly neuropathic then a reasonable trial of conservative treatment is always justified although it is hardly a triumph to keep an old person in hospital for half of his remaining life merely to save his foot [35]. What is a 'reasonable time' to persevere with conservative treatment will depend on the other disabilities listed in the problem list. If the lesion is predominantly ischaemic, the decision to amputate needs to be made earlier since it is quite likely that the patient will lose his life before he loses his remaining leg [36]. To remove a leg is disabling but ischaemia of the heart and brain poses a greater threat to the patient's life. Once the decision to amputate has been taken, close medical-surgical liaison over these 'fragile patients with diffuse multi-system disease' can result in an operative mortality as low as 1% [37]. Part of this liaison should include a joint decision about whether it is reasonable to expect the patient to walk again. Much time and money is wasted giving old people artificial limbs irrespective of their physical and mental ability to cope with them [38]. It is worth noting that the energy expenditure in using an artificial limb, especially after an above-knee amputation, is beyond the abilities of most old people especially if they have cardiac disease.

Complications which are more or less specific to the elderly diabetic

Many conditions could be included under this heading to emphasise the special problems which may confront those dealing with diabetes in old age. However, I will discuss briefly just four:

Cranial nerve palsies

Sudden paralysis of the third, sixth or rarely the fourth cranial nerve is a not uncommon event in the elderly diabetic. Differential diagnosis is from intra-cranial aneurysms or neoplasms and in one series [39] over one-third of diabetic patients had causes of ophthalmoplegia other than diabetes. The most commonly affected nerve is the third and its characteristic feature is that the pupil is spared. The onset of any of these palsies is usually sudden and pain occurs in at least a half and its presence or absence is not useful in differential diagnosis. Objective evidence of involvement of the trigeminal nerve is always absent. The natural history of diabetic ophthalmoplegia is of spontaneous and usually complete recovery within 6 weeks to 3 months. Investigations should include an erythrocyte sedimentation rate to exclude the Tolosa-Hunt syndrome [40] but radiological investigations are required only if spontaneous resolution does not occur.

Malignant otitis externa

Malignant otitis externa is a necrotising infection of the external auditory canal which occurs almost exclusively in elderly diabetic patients [41, 42]. It is caused by *Pseu-*

domonas aeruginosa and if untreated can invade cartilage, bone, nerves and soft tissues resulting in osteomyelitis of the skull, multiple cranial nerve palsies and death. The diagnosis is a clinical one and requires a high index of suspicion. The characteristic signs are pain and severe tenderness of the tissues around the ear, usually associated with a discharge. Treatment should be aggressive with full doses of carbenicillin and gentamicin.

Renal papillary necrosis [43, 44]

The elderly patient is not immune from renal failure due to diabetic glomerulosclerosis. Nevertheless, when an elderly patient, especially a woman, presents with an insidious onset of renal failure it is important to bear in mind the possibility of renal papillary necrosis. At least half of patients with this condition are over 60 years old and at least one-third *do not* present with a high fever and loin pain. Prevention by aggressive treatment of urinary tract infection in elderly diabetic women is obviously the ideal but, even if papillary necrosis is already present, renal function can often be stabilised for several years by continuous antibiotic treatment.

Diabetic amyotrophy

This condition, originally described by Garland [45], is most common in elderly men and is usually the presenting symptom of diabetes which is mild in the sense that it can be controlled by diet alone. There is a progressive and painful weakness of the muscles of the pelvic girdle and thigh which is characteristically asymmetrical and associated with only mild sensory changes. The condition is self-limiting and usually resolves spontaneously within 6–12 months.

I regard diabetic neuropathic cachexia [46] as an extreme end of the spectrum of which amyotrophy is a part. Diabetic neuropathic cachexia may be a highly dramatic illness as the following case history demonstrates: a 66-year-old woman was seen in July 1979 complaining of aching in her shoulders and thighs, weakness of her shoulders and pelvic girdle and severe weight loss so that, although 153 cm tall, she weighed only 39 kg. The general practitioner had told the family that she almost certainly had cancer but referred her to our unit because of the finding of glycosuria. On examination, the only findings were severe weight loss with gross muscular wasting most marked proximally. She was treated with 6 units of intermediate-acting insulin twice daily in spite of the relative mildness of her diabetes. Even with intensive physiotherapy progress was slow and for nearly a year she was unable to stand or walk without assistance. By June 1980 her weight had risen to 56.6 kg and gradually over the second year after presentation her muscular power returned to normal so that by July 1982 she was fully mobile and weighed 70 kg. Insulin was stopped and when last seen in July 1983 her diabetes was well controlled on diet alone with a haemoglobin A_1 of 8.6%.

Conclusions

My intention has been to suggest that there are enough subtle differences between diabetes in the old and that in young to make management of the former a speciality in its own right. Elderly patients with diabetes are likely to have not only complications of the disease but also other complicating diseases. To avoid adding iatrogenic complications requires a good knowledge of applied pharmacology as well as a carefully-designed treatment plan with a single named individual in overall charge. Many old people perceive diabetes as a matter of little concern [47] so that those looking after them must be especially diligent.

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