

DIABETIC PATIENTS OF ADVANCED AGE: COMPLICATIONS AND TREATMENT

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Background: Diabetes mellitus (DM) has a significant risk for late complications, micro- and/or macroangiopathic.

Patients and Methods: The authors analyzed the means of treatment, occurrence of complications, and frequency of use of intensified regimens, in 705 diabetics aged 79 ± 8.8 years (SD), who were admitted to the Geriatric Department of University Hospital over 3 years (1996-1999).

Results: The duration of DM had been 14 ± 11.8 years. 41% of the hospitalized diabetics were treated by diet, 36% by peroral antidiabetic drugs (PAD), 20% by insulin, and 3% by a combination of insulin and PAD. An insulin I.V. drip with a pump was used in 49 of the patients in hospital, and a conventional intensified insulin regime (4 or more times daily) in 96 patients. Late complications of DM were as follows: 1) *microangiopathy*: retino- 20.3%, nephro- 19.8% and neuropathy 25.6%; 2) *macroangiopathy*: coronary artery disease 80%, stroke or TIA 46.2%, diabetic foot syndrome 21.4%, and associated amputation 6.1%.

Conclusions: Immediate effective treatment should overcome acute complications and inhibit development of late complications.

Key words: Diabetes mellitus, insulin resistance, late complications of diabetes, advanced age, treatment of diabetes

INTRODUCTION

Diabetes mellitus (DM) in geriatrics is a most serious metabolic impairment.¹⁻⁴ DM affects 15–20% of the elderly population.^{5,6} The main reason for decreased glucose tolerance in old age is the gradual development of insulin resistance, especially of a post-receptor character.⁷⁻¹⁰

We reviewed the elderly diabetics in the inpatient geriatric department of Brno University Hospital. The methods of treatment, levels of control, occurrence of complications, number of intensified insulin regimens necessary for the present complication, and other clinically relevant anamnestic and laboratory data were analyzed.

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PATIENTS AND METHODS

A retrospective study was carried out on the 2,025 patients who were hospitalized on the Geriatric Unit over the 3 years 1996-1999. All patients underwent a complete physical and laboratory examination, which included assessment of glycosylated hemoglobin, fructosamine, C-peptide (fasting and after stimulation), ophthalmological, renal and other examinations according to the present state.

Of this entire population, 1,220 patients were non-diabetics (65%) aged 78 ± 9.2 years (standard deviation), and 705 were diabetics (35%) aged 79.0 ± 8.8 . Of the 705 diabetics, 447 were women (mean age 81) and 258 were men (mean age 76). DM had originally been found at age 67.1 ± 12.8 years, and duration of DM had been 9.1 ± 7.2 years. Those on insulin had this therapy for 7.5 ± 2.7 years.

Figure 1 presents treatment of the DM at the time of hospital admission: 41% by diet, 36% by peroral antidiabetic drugs (PAD) – sulphonylurea (SU) or metformin, 20% by insulin, and 3% by a combination of insulin and PAD.

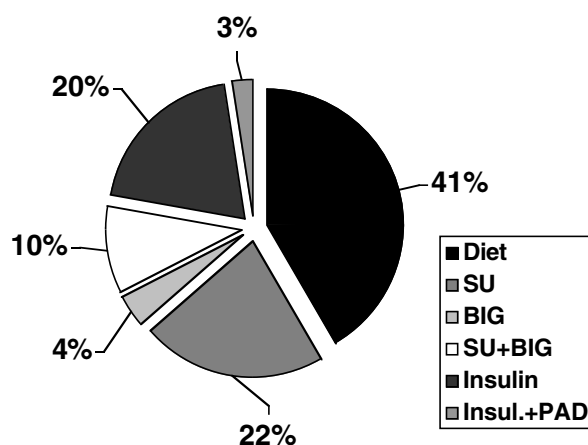


Figure 1. Treatment of diabetes at time of admission to inpatient geriatric unit. SU = sulphonylurea; BIG = biguanides; insul.+PAD = insulin+peroral antidiabetic drugs.

RESULTS

Table 1 shows the late complications found on hospitalization in these 705 diabetics.

Table 2 shows fasting C-peptide and glycosylated hemoglobin (HBA_{1c}) at the time of acceptance to the geriatric department for the groups treated by diet, PAD and insulin. The degree of control of those diabetics on insulin, reflected in the level of HBA_{1c}, was significantly worse when compared with both other groups and also statistically significant in the differences of the C-peptide levels.

Table 3 presents values of the HBA_{1c} divided into three zones. Almost 46.7% of the diabetics had HBA_{1c} <7.5% (good). Satisfactory control was found in 25.2% of the diabetics. Of the 198 poorly controlled diabetics (HBA_{1c} >8.5%), 10 patients were treated by diet, 59 patients by PAD and 129 patients by insulin before hospitalization.

We found C-peptide below 0.6 ng/ml in 35 of the patients (4.9% of the 705 diabetics). Its average value in this subgroup was 0.25 ± 0.16 ng/ml. Eight patients aged 74.2 ± 4.4 years had suffered from type 1 DM for 1-43 years, and 27 patients age 72.5 ± 5 years had the *latent autoimmune diabetes in the adult* (LADA) type of DM. In the latter group, DM had been found at age 58.8 ± 7.7 years, and PAD failure had occurred after 7.8 ± 2.5 years of being diabetic. Regarding the presence of the complications of DM given below, conventional intensified insulin therapy was instituted in 96 patients, and I.V. insulin drip therapy with an insulin-pump (Disetronic-H-tron™, Medatron, Switzerland) in 49 patients. The reasons for intensified insulin therapy in some cases overlap each other (which explains their higher numbers): symptomatic neuropathy – 74 times; post-operative period (amputation, etc.) – 37 times; diabetic foot syndrome – 82 times; inter-current disease (especially infection) – 34 times; problematic plasma glucose control and/or DM lability – 106 times.

Table 1. Late Complications in 705 Hospitalized Diabetics

Complication	No. of Patients	%
Retinopathy	143	20.3%
Nephropathy	140	19.8%
Neuropathy	180	25.6%
Cardiovascular disease	564	79.9%
Stroke, TIA*	326	46.2%
Diabetic foot syndrome	151	21.4%
Amputation in history	43	6.1%

*transient ischemic attacks

Table 2. C-peptide and Glycosylated Hemoglobin According to the Treatment*

	Diet	PAD	Insulin
C-peptide (ng/ml)	3.1±1.7 †	1.4±2.1 †	2.7±3.0
HBA _{1c}	5.8±7.1 †	5.6±4.6 †	7.6±4.6

*±SD, †p<0.01

DISCUSSION

Progression of atherosclerosis in diabetics is approximately twice as rapid as in non-diabetics, which results in a two to five times higher incidence of cardio- and cerebrovascular complications.¹¹ Vascular diseases are responsible for mortality in 75-80% of diabetics.¹²⁻¹⁵ At the same time, diabetics have a high incidence of hypertension, obesity, hyperinsulinemia, insulin resistance, dyslipidemia, and impairment of fibrinolysis.^{10,11,16} The biological effect of insulin is usually decreased in old age, because of increasing insulin resistance. The relationship of type 2 DM to cardio- and cerebrovascular disease is much greater than with type 1 DM.^{7,8,17,18}

Both types of DM, 1 and 2, may eventually lead to identical complications, depending on control, duration and age of onset. The actual complications of DM in old age, according to our own and others' findings,^{2,5,19} does not differ from DM of younger patients.

In advanced age, type 2 DM is prevalent^{3,5,6,14} and was found in 670 people, ie. 95.1% of all older diabetics in this series. The inherent defect in the effect of insulin takes place at the post-receptor level. We found type 1 DM in 8 patients over the 3 study years, which usually reflected preceding known diabetes.

We rarely found the *latent autoimmune diabetes in the adult* (LADA),^{5,19} which is a very slowly developing type 1 DM due to autoimmune insulini-

Table 3. Glycosylated Hemoglobin and Level of Control in 705 Diabetics at Time of Admission to Geriatric Department

Level of Control of DM	HBA _{1c}		
	Good (<7.5)	Satisfactory (7.5-8.5)	Poor (>8.5)
Absolute number	329	178	198
Percent (%)	46.6	25.2	28.2

tis, manifested by late failure of peroral antidiabetic drugs. This infrequent form of adult onset DM usually occurs in individuals above age 35. At the beginning, it is manifested the same way as the type 2 DM and is usually controlled by diet and PAD, but after several years the patient becomes dependent on insulin, and shows low C-peptide levels and glutamic acid decarboxylase antibodies. In fact, it is a very slowly developing type 1 DM.¹⁹ In our series, we found this type of DM in 27 patients (3.8%). The C-peptide level in this subgroup averaged 0.25 ng/ml and did not increase after stimulation.*

Type 2 DM in old age is a consequence of the interaction of genetic factors and environmental influences.

The level of control of the diabetics in this series at the time of hospital admission (Table 3), represented by HBA_{1C}, showed poor control (HBA_{1C} > 8.5% in 28.1% of diabetics). These results suggest that in the outpatient care, there should be more attention to the treatment and control in older diabetics.^{16,18,20-22} It is noteworthy that diabetics treated by insulin had significantly higher HBA_{1C}, compared with diabetics on diet or PAD (Table 2).

The late complications increase with duration of DM.^{2,3,14,21} Macroangiopathic complications are typical of type 2 DM.^{7-9,13,14} In one-third of cases of cardiovascular disease, DM is the main cause. The diabetic foot syndrome, which is a combination of neuro- and macroangiopathy, occurs in 15-20% of diabetics, and results in amputation in 0.5-1%.^{15,18} The severity of DM in our patients is illustrated by the fact that diabetic foot syndrome was present in 21.4% and amputation in 6.1% (Table 1).

When choosing therapy for DM, one must consider the diabetic's age (including life-expectancy), presence of macroangiopathic complications, level of self-sufficiency or dependence, family support, environment, the economic situation, previous dietary habits, dentition, and handicaps, eg. psychic, motor, visual and hearing deficiencies. The first step in treatment is a reasonable diet, emphasizing a low-energy content. In our series, we used diet alone in 41% of patients (Figure 1). For medication,^{9,20,22-24} we used metformin (in some patients

in combination with SU or insulin), especially with obese diabetics to influence the hepatic component of the insulin resistance syndrome. Metformin was used in 14% of our patients (Figure 1), often in combination with SU. Thus, the function of the β -cells is improved. However, it was convenient with non-obese diabetics. In our 705 diabetics, SU was used in 22%.

The complications reflected the severity of the diabetes, HBA_{1C} (Table 3) and treatment, and were greatest in those requiring insulin.

Most diabetics, after a long period (especially with insufficient compliance), become insulin-dependent, and then require insulin therapy.^{5,22,24} It is noteworthy that 156 of our patients (23%) were treated by insulin (including the 3% combined with PAD), which indicates that these patients suffered from advanced DM, which was accompanied by the serious complications. In certain patients, intensified insulin therapy was necessary. Thus, in 94 patients we instituted an intensified insulin regimen in the form of small preprandial bolus doses of quick-acting and at 2200 hrs medium-acting insulin. We also used an insulin drip with a pump (Disetronic H-tron) in 49 patients for short periods (2-4 weeks) during hospitalization. In all these patients, it was a temporary solution for the situation in hospital.

The target of good control for self-sufficient elderly diabetics (about two-thirds of our series) does not substantially differ from younger diabetics.⁵ The limited self-sufficiency in one-third of the diabetic patients was usually caused by cardiac, respiratory and other complications, and not by the DM itself.

The selection of diabetic patients for hospitalization in the geriatric department over the 3 years was influenced by the severity and degree of not only the metabolic disease but also the other complications. The main goal of treatment of elderly diabetics is improvement in quality of life, which is expressed by the following:

- optimum metabolic control.
- prevention of weakness, weight loss, polyuria, infectious complications.
- setting requirements for lifestyle, especially diet.
- restriction of drugs with hypo- and hyperglycemic risks.
- achieving and retaining optimum weight

If insulin therapy is being started, it is necessary to answer the following questions:

*C-peptide levels normally increase 2-3 times after stimulation. Stimulation was done by a standard breakfast containing 250 g of glycidides, with measurements carried out 60 mins later. In type 1 DM and LADA, C-peptide level does not increase after stimulation, but remains very low.

- By whom will the insulin be injected?
- What are the possibilities of checking glycemia?
- How can the patient be helped in the instance of hypoglycemia if he or she lives alone?

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