Clinical and economic benefits of the new antidiabetic drugs in the Czech Republic

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Summary

Goal: Description of efficiency, safety and cost-effectiveness of the therapy with new antidiabetics from the incretins group for the patients whose treatment with DPP4 inhibitors and GLP1 receptor agonists respectively, commenced based on the real data from the routine clinical practice in the Czech Republic. **Methodology:** Collection of clinical data before the commencement of treatment and in the following 12 months. The following data was collected for all patients: demographic data, time elapsed from diagnosis, body weight, BMI, HbA_{1c}, systolic and diastolic blood pressure, total cholesterol, LDL-cholesterol, HDL-cholesterol and triglycerides. After that a pharmaco-economic model was analyzed which can predict long-term incidence of microvascular and macrovascular complications, life span and a quality-adjusted life-year (QALY) span of life. **Results:** The data of 320 patients followed for 12 months was analyzed (255 treated with DPP4 inhibitors and 65 treated with GLP1 receptor agonists). The patients' average age was 60.4/57.9 years and this innovative therapy was commenced for them after 9.1 years on average from their being diagnosed with diabetes. The initial glycated hemoglobin was higher (7.0%, or 7.6% HbA_{1c}/IFCC). The previous therapy had been mainly based on metformin and on sulfonylurea derivatives. After 12 months of treatment statistically significant decreases were recorded in glycated hemoglobin (by 1.4% and 1.8% resp.), systolic blood pressure (by 4.7 mm Hg and 4.6 mm Hg resp.), diastolic blood pressure (by 1.8 mm Hg and 3.0 mm Hg resp.), LDL-cholesterol (by 0.3 mmol/l), triglycerides (by 0.4 mmol/l and 0.2 mmol/l resp.), body weight (by 1.6 kg and 4.5 kg resp.) and BMI (by 0.5 and 1.6 resp.). The pharmacoeconomic model predicted that the improvement of diabetes compensation in the group of DPP4 inhibitors would lead in one diabetic patient to life extension by 0.36 year and by 0.31 QALY, and in the group of GLP1 agonists by 0.45 year and by 0.39 QALY. **Conclusion:** The analysis has shown that the treatment based on modern antidiabetic medications in the conditions of the Czech Republic reduces the incidence of microvascular and macrovascular complications, extends the life span and the standard quality (QALY) life span and, due to the prevented complications, also reduces health insurance spending.

Key words: GLP1 receptor agonists – diabetes mellitus – pharmacoeconomics – DPP4 inhibitors – QALY

Introduction

Diabetes mellitus is a chronic life-long condition which shortens life expectancy, reduces quality of life and entails significantly higher costs as compared with a population without this diagnosis. Both foreign and Czech data clearly shows that most of the healthcare costs is expended on the treatment of complications. The cost of hospitalization for patients with type 2 diabetes (DM2T) in the Czech Republic reached 61 % of the direct cost of the diagnosis and the overall cost of the diagnosis is approx. 10 % of all healthcare costs [1].

Cross-cutting analyses of data from the Czech Republic indicate that the compensation of the Czech diabetic population is far from satisfactory. For instance a recently presented analysis of 3 905 patients has shown that target values of glycated hemoglobin according to recommended procedures (5.3 %) are reached by less than 50 % of treated patients with diabetes [2]. Poorer diabetes compensation in terms of higher values of glycated hemoglobin, blood pressure, body weight and blood lipids increases the risk of incidence of microvascular and macrovascular complications, whereby increasing the cost of therapy of this disease.

New antidiabetic drugs from the group of DPP4 inhibitors and GLP1 agonists have been used in the therapy of DM2T in the Czech Republic for several years now; they are an option for improving diabetes compensation and patients' prognosis and offer a chance to get the cost of treatment of complications under control. Now we have the first outcomes of the project which is mapping the clinical and economic effects and benefits of the therapy using these groups of antidiabetic drugs in the real clinical practice for patients with type 2 diabetes mellitus.

Methodology

The aim of the project was to describe, based on the real data from the routine clinical practice in the Czech

Republic, the efficiency, safety and cost-effectiveness of patients who had a therapy with DPP4 inhibitors or GLP1 agonists commenced.

During the 1st phase the collection of clinical data was carried out for the period before the commencement of treatment with modern antidiabetic drugs and for the following 12 months. The following data was collected for all patients: demographic data, time elapsed from diagnosis, body weight, BMI, HbA_{1c}, systolic and diastolic blood pressure, total cholesterol, LDL-cholesterol, HDL-cholesterol and triglycerides.

During the 2nd phase the gained clinical data was put in the pharmacoeconomic model which is able to predict, based on large mortality prognostic cohorts (Framingham, UKPDS, ACCORD), a long-term incidence of microvascular and macrovascular complications, a life span and standard quality life span (QALY – Quality Adjusted Life Years) [3–6].

Results

Within the project, the data of 320 patients (255 treated with DPP4 inhibitors and 65 with GLP1 agonists) was analyzed, who had been transferred to this therapy and followed for 12 months. An average age of the patients was 60.4/57.9 years and they were transferred to this innovative treatment after an average time-period of 9.1 years from their diagnosis of diabetes and with average high values of glycated hemoglobin (7.0 %, or 7.6 % HbA_{1c}). The previous therapy had been mainly based on metformin and on sulfonylurea derivatives. After 12 months of treatment statistically significant decreases were achieved in glycated haemoglobin (by 1.4 % and 1.8 % resp.), Chart 1, systolic blood pressure (by 4.7 mm Hg and 4.6 mm Hg resp.), diastolic blood pressure (by 1.8 mm Hg and 3.0 mm Hg resp.), LDL-cholesterol (by 0.3 mmol/l), triglycerides (by 0.4 mmol/l and 0.2 mmol/l resp.), body weight (by 1.6 kg and 4.5 kg resp.) and BMI (by 0.5 and 1.6 resp.) Chart 2.

The obtained results were subsequently put into a long-term pharmacoeconomic model which builds on the UKPDS longitudinal cohort of patients and can predict benefits in the long run (prevention of microvascular and macrovascular complications) and long-term costs (the costs of therapy alone and treatment of complications).

The results of economic simulations over a time span of 20 years show that the transfer of poorly compensated patients with type 2 diabetes to up-to-date antidiabetic drugs as compared to the condition where the treatment continues without satisfactory improvement, has a significant impact on the span of life and the standard quality life years (QALY). in the group of DPP4 inhibitors, life expectancy is extended by 0.36 year and QALY by 0.31 year per one diabetic patient, and in the group of GLP1 agonists life expectancy by 0.45 year and QALY by 0.39.

The pharmacoeconomic model predicted the improvement in diabetes compensation to be accompanied by a reduced incidence of microvascular and macrovascular complications. For example the cumulative incidence of End-Stage Renal Disease (ESRD) was reduced from 7.87 to 6.95 cases per 100 patient years with DPP4-inhibitor treatment and from 10.35 to 8.52 cases with GLP1-agonist treatment. The differences in the cumulative percentage incidence of cardiovascular complications of diabetes are shown by Chart 3 (DPP4 inhibitors) and Chart 4 (GLP1 agonists).

The analysis of the overall percent representation of all healthcare costs shows the cost related to the treatment of complications being the largest (47.6 % goes to microvascular and 18.4 % to macrovascular complications) and only a smaller part (28.2 %) is invested in DPP4 inhibitors, Chart 5.

Discussion

The results show that in comparison with the therapy the patients received before the new antidiabetic drugs were introduced, the transition to DPP4 inhibitors and GLP1 agonists brings with it prolonged life expectancy, including more QALY years. It also effects cost savings in the area of treatment of complications covered by health insurance. The results expressed on the scale of a cohort comprising 1 000 patients with

Chart 1. Development of glycated hemoglobin over time

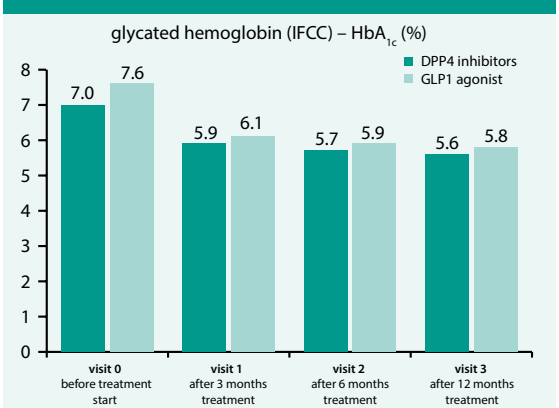


Chart 2. Development of BMI value over time

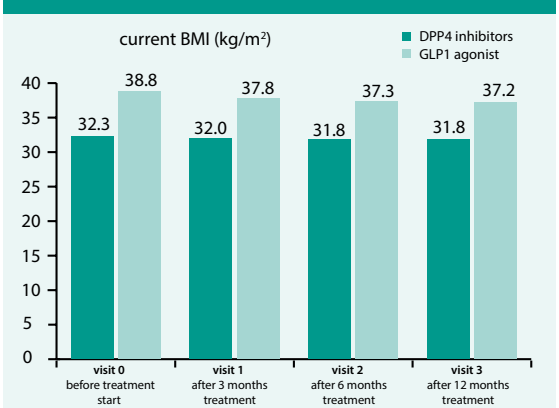
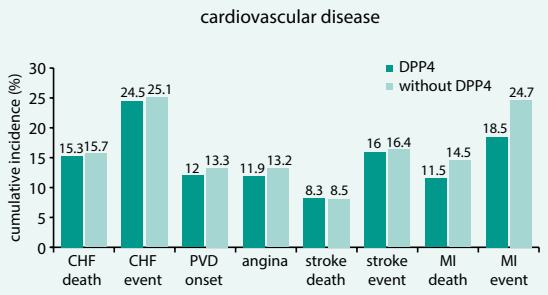
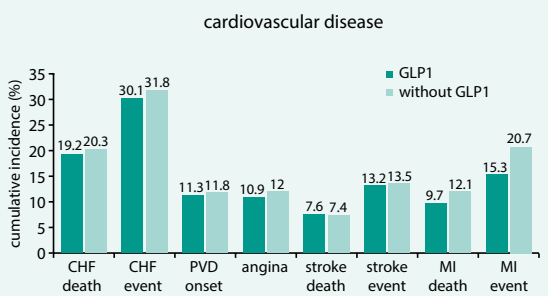


Chart 3. Cumulative 20-year incidence of cardiovascular complications in DPP4 inhibitor therapy



angina – new onset of manifestation of angina pectoris/non-stable angina pectoris syndrome **CHF death** – death caused by heart failure **CHF event** – new manifestation of heart failure **MI death** – death caused by acute myocardial infarction **MI event** – acute myocardial infarction **PVD onset** – new onset of lower limb ischemia **stroke death** – death caused by stroke **stroke event** – new onset of stroke

Chart 4. Cumulative 20-year incidence of cardiovascular complications in GLP1 agonist therapy



angina – new onset of manifestation of angina pectoris/non-stable angina pectoris syndrome **CHF death** – death caused by heart failure **CHF event** – new manifestation of heart failure **MI death** – death caused by acute myocardial infarction **MI event** – acute myocardial infarction **PVD onset** – new onset of lower limb ischemia **stroke death** – death caused by stroke **stroke event** – new onset of stroke

Chart 5. Structure of overall costs for the therapy with DPP4 inhibitors

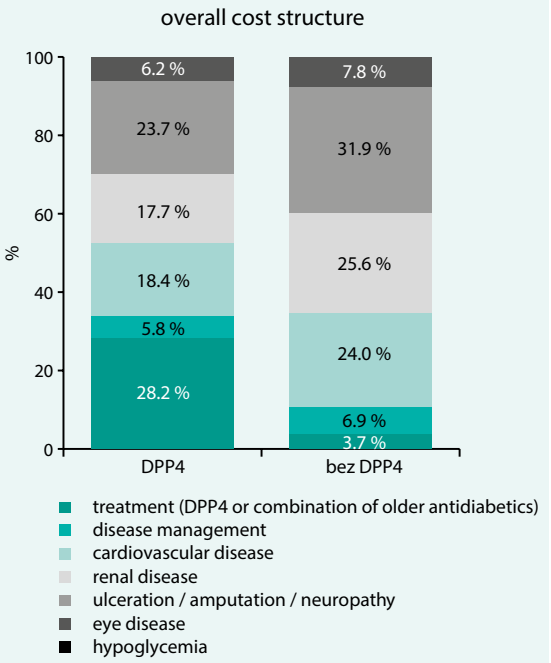


Table. Cost saving and benefits brought by new antidiabetic drugs per 1 000 patients in treatment

	DPP4	GLP1
Cardiovascular complications	CZK 143.1M	CZK 149.0M
Renal complications	CZK 191.0M	CZK 231.3M
Diabetic foot	CZK 165.9M	CZK 176.5C
Eye complications	7,8 mil. Kč	8,5 mil. Kč
Gained life years	289 let	276 let
Gained QALY	249 QALY	288 QALY

type 2 diabetes [Table] show that a cohort using new antidiabetics gains 289/276 life years and 249/288 QALY years within a 20-year time span. The treatment of complications will further bring savings over CZK 500 million in relation to DPP4-inhibitor therapy and over CZK 560 million related to GLP1-agonist therapy, in comparison with the older therapeutic methods.

The cost of the new antidiabetic medication is higher, thereby increasing the cost of pharmacotherapy from the perspective of health insurance companies. However its efficiency and safety at the same time provides for a better quality treatment for patients with type 2 diabetes and improvement in their prognosis. This clinical and economic analysis has shown that the treatment using modern antidiabetic medications in the conditions of the Czech Republic reduces the incidence of microvascular and macrovascular complications, extends the life span and the standard quality (QALY) life years and the prevented complications also considerably reduce health insurance spending.

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