

# Pilot Program Reduces CV Risk in Type 2 Diabetes

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COLORADO SPRINGS — A novel pharmacist-led, multidisciplinary program of group medical visits for patients with type 2 diabetes can reduce multiple cardiovascular risk factors, randomized trial data show.

More than 21 million Americans have type 2 diabetes. Two-thirds will die of cardiovascular disease. Traditional one-on-

one interactions between patient and nurse or physician are not a practical way to address the multiple elevated cardiovascular risk factors typically present in the diabetic population, Tracey H. Taveira, Pharm.D., said at a conference sponsored by the American Heart Association.

A collaborative, multidisciplinary intervention that involves groups of patients provides economy of scale and the opportunity to harness group dynamics constructively. Plus, a program led by a phar-

maciast instead of a physician offers significant cost advantages simply because of the substantially lower cost of a pharmacist's time, explained Dr. Taveira, a pharmacist at the Providence (R.I.) VA Medical Center.

She presented a randomized controlled prospective trial that evaluated the effectiveness of a program—the Multidisciplinary Education and Diabetes Intervention for Cardiac risk reduction, or MEDIC—that she and her colleagues developed at the VA

center. The study involved 110 men with type 2 diabetes who had a hemoglobin A<sub>1c</sub> (HbA<sub>1c</sub>) value of 7%-9% within the previous 6 months. Half were obese. The men were randomized to MEDIC or to usual care, which included an invitation to participate in the hospital's American Diabetes Association-certified diabetes program, as well as an obesity program.

Participation in MEDIC involved a 2-hour meeting weekly for 4 weeks. There were six to eight patients per class. The first hour of each session involved patient education provided by a registered dietitian, a physical therapist, and a nurse with expertise in the behavioral aspects of cardiovascular risk and diabetes. The educational content, adapted from national guidelines for diabetes self-management, was delivered using principles of social learning theory. Patients learned to carry a personal health care report card; set behavioral and health outcome goals; and self-monitor blood pressure, blood glucose, and physical activity. All patients received weekly individualized dietary and physical exercise homework.

In the second hour of each class, a clinical pharmacist credentialed as a certified diabetes educator aggressively titrated medications for the treatment of diabetes, hypertension, hyperlipidemia, and tobacco cessation using algorithms adapted from national guidelines.

The study end points involved changes in cardiovascular risk factors 4 months from baseline. Systolic blood pressure in the MEDIC group fell by 7.3 mm Hg from a mean of 134 mm Hg at baseline, compared with a 1.7-mm Hg decrease in the usual-care group. From a baseline diastolic blood pressure of 74 mm Hg, there was a 6.5-mm Hg drop in MEDIC patients and a 1.0-mm Hg increase in controls.

HbA<sub>1c</sub> decreased by 0.9% in MEDIC patients from a baseline of 8.1%, and by 0.1% with usual care. The total cholesterol/HDL ratio dropped from 4.6 to 4.2 in the MEDIC group and increased from 4.3 to 4.4 in controls. From a mean baseline LDL level of 93 mg/dL, there was a 12.2-mg/dL decrease in the MEDIC patients and a 7.8-mg/dL drop in the usual-care group. Body mass index declined from 33.9 kg/m<sup>2</sup> at baseline to 33.7 kg/m<sup>2</sup> in the MEDIC group, and was unchanged over time in controls.

Half of MEDIC patients achieved an HbA<sub>1c</sub> below 7%, as did 28% of controls. Two-thirds of MEDIC patients got their systolic blood pressure below 130 mm Hg, compared with 39% of controls. A diastolic blood pressure less than 80 mm Hg was achieved in 88% of MEDIC patients and in 69% of the usual-care arm.

The overall cardiovascular risk burden as reflected in the United Kingdom Prospective Diabetes risk score decreased by 15% at 4 months in the MEDIC group and increased by 3% in controls, Dr. Taveira continued.

Based on the success of this single-center pilot trial, a larger multicenter randomized controlled trial of MEDIC is underway, as is a separate study assessing the program's utility in diabetic individuals with comorbid mental illness. ■

## ADVERSE REACTIONS

**Clinical Trials Experience.** Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

**Sitagliptin and Metformin Co-administration in Patients with Type 2 Diabetes Inadequately Controlled on Diet and Exercise.** The most common (≥5% of patients) adverse reactions reported (regardless of investigator assessment of causality) in a 24-week placebo-controlled factorial study in which sitagliptin and metformin were co-administered to patients with type 2 diabetes inadequately controlled on diet and exercise were diarrhea (sitagliptin + metformin [N=372], 7.5%; placebo [N=176], 4.0%), upper respiratory tract infection (6.2%, 5.1%), and headache (5.9%, 2.8%).

**Sitagliptin Add-on Therapy in Patients with Type 2 Diabetes Inadequately Controlled on Metformin Alone.** In a 24-week placebo-controlled trial of sitagliptin 100 mg administered once daily added to a twice daily metformin regimen, there were no adverse reactions reported regardless of investigator assessment of causality in ≥5% of patients and more commonly than in patients given placebo. Discontinuation of therapy due to clinical adverse reactions was similar to the placebo treatment group (sitagliptin and metformin, 1.9%; placebo and metformin, 2.5%).

**Hypoglycemia.** Adverse reactions of hypoglycemia were based on all reports of hypoglycemia; a concurrent glucose measurement was not required. The overall incidence of pre-specified adverse reactions of hypoglycemia in patients with type 2 diabetes inadequately controlled on diet and exercise was 0.6% in patients given placebo, 0.6% in patients given sitagliptin alone, 0.8% in patients given metformin alone, and 1.6% in patients given sitagliptin in combination with metformin. In patients with type 2 diabetes inadequately controlled on metformin alone, the overall incidence of adverse reactions of hypoglycemia was 1.3% in patients given add-on sitagliptin and 2.1% in patients given add-on placebo.

**Gastrointestinal Adverse Reactions.** In patients treated with sitagliptin and metformin vs patients treated with metformin alone, incidences of pre-selected gastrointestinal adverse reactions were diarrhea (sitagliptin + metformin [N=464], 2.4%; placebo + metformin [N=237], 2.5%), nausea (1.3%, 0.8%), vomiting (1.1%, 0.8%), and abdominal pain (2.2%, 3.8%).

**Sitagliptin in Combination with Metformin and Glimepiride.** In a 24-week placebo-controlled study of sitagliptin 100 mg as add-on therapy in patients with type 2 diabetes inadequately controlled on metformin and glimepiride (sitagliptin, N=116; placebo, N=113), the adverse reactions reported regardless of investigator assessment of causality in ≥5% of patients treated with sitagliptin and more commonly than in patients treated with placebo were: hypoglycemia (sitagliptin, 16.4%; placebo, 0.9%) and headache (6.9%, 2.7%).

No clinically meaningful changes in vital signs or in ECG (including in QTc interval) were observed with the combination of sitagliptin and metformin.

The most common adverse experience in sitagliptin monotherapy reported regardless of investigator assessment of causality in ≥5% of patients and more commonly than in patients given placebo was nasopharyngitis.

The most common (>5%) established adverse reactions due to initiation of metformin therapy are diarrhea, nausea/vomiting, flatulence, abdominal discomfort, indigestion, asthenia, and headache.

## Laboratory Tests

**Sitagliptin.** The incidence of laboratory adverse reactions was similar in patients treated with sitagliptin and metformin (7.6%) compared to patients treated with placebo and metformin (8.7%). In most but not all studies, a small increase in white blood cell count (approximately 200 cells/microl. difference in WBC vs placebo; mean baseline WBC approximately 6600 cells/microl) was observed due to a small increase in neutrophils. This change in laboratory parameters is not considered to be clinically relevant.

**Metformin hydrochloride.** In controlled clinical trials of metformin of 29 weeks duration, a decrease to subnormal levels of previously normal serum Vitamin B<sub>12</sub> levels, without clinical manifestations, was observed in approximately 7% of patients. Such decrease, possibly due to interference with B<sub>12</sub> absorption from the B<sub>12</sub>-intrinsic factor complex, is, however, very rarely associated with anemia and appears to be rapidly reversible with discontinuation of metformin or Vitamin B<sub>12</sub> supplementation [see Warnings and Precautions].

**Postmarketing Experience.** The following additional adverse reactions have been identified during postapproval use of JANUMET or sitagliptin, one of the components of JANUMET. Because these reactions are reported voluntarily from a population of uncertain size, it is generally not possible to reliably estimate their frequency or establish a causal relationship to drug exposure. Hypersensitivity reactions include anaphylaxis, angioedema, rash, urticaria and exfoliative skin conditions including Stevens-Johnson syndrome [see Warnings and Precautions]; upper respiratory tract infection.

## DRUG INTERACTIONS

**Cationic Drugs.** Cationic drugs (e.g., amiloride, digoxin, morphine, procainamide, quinidine, quinine, ranitidine, triamterene, trimethoprim, or vancomycin) that are eliminated by renal tubular secretion theoretically have the potential for interaction with metformin by competing for common renal tubular transport systems. Such interaction between metformin and oral cimetidine has been observed in normal healthy volunteers in both single- and multiple-dose metformin-cimetidine drug interaction studies, with a 60% increase in peak metformin plasma and whole blood concentrations and a 40% increase in plasma and whole blood metformin AUC. There was no change in elimination half-life in the single-dose study. Metformin had no effect on cimetidine pharmacokinetics. Although such interactions remain theoretical (except for cimetidine), careful patient monitoring and dose adjustment of JANUMET and/or the interfering drug is recommended in patients who are taking cationic medications that are excreted via the proximal renal tubular secretory system.

**Digoxin.** There was a slight increase in the area under the curve (AUC, 11%) and mean peak drug concentration (C<sub>max</sub>, 18%) of digoxin with the co-administration of 100 mg sitagliptin for 10 days. These increases are not considered likely to be clinically meaningful. Digoxin, as a cationic drug, has the potential to compete with metformin for common renal tubular transport systems, thus affecting the serum concentrations of either digoxin, metformin or both. Patients receiving digoxin should be monitored appropriately. No dosage adjustment of digoxin or JANUMET is recommended.

**Glyburide.** In a single-dose interaction study in type 2 diabetes patients, co-administration of metformin and glyburide did not result in any changes in either metformin pharmacokinetics or pharmacodynamics. Decreases in glyburide AUC and C<sub>max</sub> were observed, but were highly variable. The single-dose nature of this study and the lack of correlation between glyburide blood levels and pharmacodynamic effects make the clinical significance of this interaction uncertain.

**Furosemide.** A single-dose, metformin-furosemide drug interaction study in healthy subjects demonstrated that pharmacokinetic parameters of both compounds were affected by co-administration. Furosemide increased the metformin plasma and blood C<sub>max</sub> by 22% and blood AUC by 15%, without any significant change in metformin renal clearance. When administered with metformin, the C<sub>max</sub> and AUC of furosemide were 31% and 12% smaller, respectively, than when administered alone, and the terminal half-life was decreased by 32%, without any significant change in furosemide renal clearance. No information is available about the interaction of metformin and furosemide when co-administered chronically.

**Nifedipine.** A single-dose, metformin-nifedipine drug interaction study in normal healthy volunteers demonstrated that co-administration of nifedipine increased plasma metformin C<sub>max</sub> and AUC by 20% and 9%, respectively, and increased the amount excreted in the urine. T<sub>max</sub> and half-life were unaffected. Nifedipine appears to enhance the absorption of metformin. Metformin had minimal effects on nifedipine.

**The Use of Metformin with Other Drugs.** Certain drugs tend to produce hyperglycemia and may lead to loss of glycemic control. These drugs include the thiazides and other diuretics, corticosteroids, phenothiazines, thyroid products, estrogens, oral contraceptives, phenytoin, nicotinic acid, sympathomimetics, calcium channel blocking drugs, and isoniazid. When such drugs are administered to a patient receiving JANUMET the patient should be closely observed to maintain adequate glycemic control.

In healthy volunteers, the pharmacokinetics of metformin and propranolol, and metformin and ibuprofen were not affected when co-administered in single-dose interaction studies.

Metformin is negligibly bound to plasma proteins and is, therefore, less likely to interact with highly protein-bound drugs such as salicylates, sulfonamides, chloramphenicol, and probenecid, as compared to the sulfonylureas, which are extensively bound to serum proteins.

## USE IN SPECIFIC POPULATIONS

### Pregnancy

#### Pregnancy Category B.

**JANUMET.** There are no adequate and well-controlled studies in pregnant women with JANUMET or its individual components; therefore, the safety of JANUMET in pregnant women is not known. JANUMET should be used during pregnancy only if clearly needed.

Merck & Co., Inc., maintains a registry to monitor the pregnancy outcomes of women exposed to JANUMET while pregnant. Health care providers are encouraged to report any prenatal exposure to JANUMET by calling the Pregnancy Registry at (800) 986-8999.

No animal studies have been conducted with the combined products in JANUMET to evaluate effects on reproduction. The following data are based on findings in studies performed with sitagliptin or metformin individually.

**Sitagliptin.** Reproduction studies have been performed in rats and rabbits. Doses of sitagliptin up to 125 mg/kg (approximately 12 times the human exposure at the maximum recommended human dose) did not impair fertility or harm the fetus. There are, however, no adequate and well-controlled studies with sitagliptin in pregnant women.

Sitagliptin administered to pregnant female rats and rabbits from gestation day 6 to 20 (organogenesis) was not teratogenic at oral doses up to 250 mg/kg (rats) and 125 mg/kg (rabbits), or approximately 30 and 20 times human exposure at the maximum recommended human dose (MRHD) of 100 mg/day based on AUC comparisons. Higher doses increased the incidence of rib malformations in offspring at 1000 mg/kg, or approximately 100 times human exposure at the MRHD.

Sitagliptin administered to female rats from gestation day 6 to lactation day 21 decreased body weight in male and female offspring at 1000 mg/kg. No functional or behavioral toxicity was observed in offspring of rats.

Placental transfer of sitagliptin administered to pregnant rats was approximately 45% at 2 hours and 80% at 24 hours postdose. Placental transfer of sitagliptin administered to pregnant rabbits was approximately 66% at 2 hours and 30% at 24 hours.

**Metformin hydrochloride.** Metformin was not teratogenic in rats and rabbits at doses up to 600 mg/kg/day. This represents an exposure of about 2 and 6 times the maximum recommended human daily dose of 2000 mg based on body surface area comparisons for rats and rabbits, respectively. Determination of fetal concentrations demonstrated a partial placental barrier to metformin.

**Nursing Mothers.** No studies in lactating animals have been conducted with the combined components of JANUMET. In studies performed with the individual components, both sitagliptin and metformin are secreted in the milk of lactating rats. It is not known whether sitagliptin is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when JANUMET is administered to a nursing woman.

**Pediatric Use.** Safety and effectiveness of JANUMET in pediatric patients under 18 years have not been established.

**Geriatric Use.** **JANUMET.** Because sitagliptin and metformin are substantially excreted by the kidney and because aging can be associated with reduced renal function, JANUMET should be used with caution as age increases. Care should be taken in dose selection and should be based on careful and regular monitoring of renal function [see Warnings and Precautions].

**Sitagliptin.** Of the total number of subjects (N=3884) in Phase II and III clinical studies of sitagliptin, 725 patients were 65 years and over, while 61 patients were 75 years and over. No overall differences in safety or effectiveness were observed between subjects 65 years and over and younger subjects. While this and other reported clinical experience have not identified differences in responses between the elderly and younger patients, greater sensitivity of some older individuals cannot be ruled out.

**Metformin hydrochloride.** Controlled clinical studies of metformin did not include sufficient numbers of elderly patients to determine whether they respond differently from younger patients, although other reported clinical experience has not identified differences in responses between the elderly and young patients. Metformin should only be used in patients with normal renal function. The initial and maintenance dosing of metformin should be conservative in patients with advanced age, due to the potential for decreased renal function in this population. Any dose adjustment should be based on a careful assessment of renal function [see Contraindications; Warnings and Precautions].



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