Mechanism of Action and Use of Metformin in Patients With Diabetes

Our easy-to-read fact sheets provide clinicians with reliable information to share with patients and their caregivers.

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood-sugar levels. There are various classifications and pathophysiologies of diabetes.

Metformin

Metformin is an antidiabetic medication that falls under a drug class called biguanides. Metformin is FDA approved to be used together with diet and exercise to improve blood-sugar control among adults and children aged 10 years or older with type 2 diabetes.

Metformin decreases how much glucose the liver produces, decreases how much glucose the intestines absorb, and increases insulin sensitivity. Increasing insulin sensitivity allows the body to better use the insulin it’s already producing. Metformin does not affect how much insulin the body is producing.

Metformin can be a good treatment option for patients with different types of diabetes, as indicated below.

Prediabetes

Prediabetes occurs when an individual's blood-sugar levels are higher than normal but not high enough to be classified as diabetes. Those with prediabetes have a higher chance of developing type 2 diabetes. For some individuals, this is a reversible condition through lifestyle modifications and medications.

Metformin's place in therapy: Metformin can be used in individuals with prediabetes at high risk for type 2 diabetes, but lifestyle modifications have been shown to decrease the risk more than the use of metformin. Metformin
shows greater benefit for individuals with a higher body mass index (BMI) who have prediabetes.

**Type 1 Diabetes**

Type 1 diabetes is also known as insulin-dependent diabetes or juvenile-onset diabetes. Approximately 5 to 10% of patients with diabetes fall under this category. Type 1 diabetes is an autoimmune disorder that causes the body to gradually stop making insulin, leading to high blood-sugar levels.

**Metformin's place in therapy:** There is limited evidence of the efficacy of metformin among patients with type 1 diabetes, but there may be benefit among patients aged older than 65 years and those who are overweight or obese.

**Type 2 Diabetes**

Type 2 diabetes is also known as non-insulin-dependent diabetes or adult-onset diabetes. Approximately 90 to 95% of patients with diabetes fall under this category. This occurs when your body produces insulin but is unable to use it well.

Type 2 diabetes progresses slowly. It is often underdiagnosed until symptoms — including weight loss, growth impairment, blurry vision, frequent urination, and extreme thirst — begin to appear, indicating severely high blood-sugar levels.

Lifestyle modifications are important for the management of diabetes and to prevent long-term organ damage, particularly in the eyes, kidney, heart, and nerves.

**Metformin's place in therapy:** Metformin is the first line of therapy for patients with type 2 diabetes or at high risk of type 2 diabetes.
Gestational Diabetes

During pregnancy (and more commonly during the second or third trimester), patients could develop glucose intolerance that usually resolves after childbirth or towards the end of the pregnancy. Approximately 1 to 14% of patients who are pregnant may experience gestational diabetes.

Weight loss for individuals more than 20% over their ideal body weight, exercise, and maintaining a healthy diet may lower the risk of developing type 2 diabetes.

**Metformin's place in therapy:** Metformin is not recommended as first-line medications for individuals who are pregnant because it crosses the placenta. Individuals with a history of gestational diabetes who later have prediabetes are recommended to undertake lifestyle modifications with or without metformin to prevent diabetes.

**Frequently Asked Patient Questions**

**Are there any side effects associated with metformin use?**

Metformin is generally considered safe and well-tolerated. Common side effects include diarrhea, nausea, vomiting, flatulence, indigestion, abdominal discomfort, and headaches. If you experience these symptoms, speak with your doctor — starting at a lower dose and slowly increasing the dose may help with some of these side effects.

Long-term use of metformin may be associated with vitamin B12 deficiency. Your doctor should be measuring your vitamin B12 level periodically.

**Are there any drug interactions with metformin?**

Metformin could significantly interact with alcohol; topiramate, zonisamide, acetazolamide, and dichlorphenamide; insulin; oral contraceptives; and certain blood pressure medications. Share your medication history with your doctor before taking metformin.
Who shouldn’t take metformin?

Individuals who are pregnant, are anticipating to become pregnant, have kidney insufficiency, or have impaired liver function should not take metformin. Consult with your doctor before beginning metformin if you have any of these conditions.

When should I stop taking metformin?

If you’re experiencing symptoms of lactic acidosis, discontinue metformin immediately and contact your doctor. Lactic acidosis can present as malaise, respiratory distress, abdominal pain, drowsiness or a strong desire to fall asleep, or muscle pain.

If you’re successfully managing your diabetes with lifestyle changes, your doctor may suggest you stop taking metformin. This may happen if your hemoglobin A₁c level is less than 6.5% for at least 6 months.