The role of metformin in kidney dysfunction

Banafsheh Yalameha

Department of Biochemistry, School of Medicine, Lorestan University of Medical Sciences, Khorramabad, Iran

Abstract
Diabetes is one of the causes leading to chronic kidney disease and finally end-stage renal failure. Diabetic nephropathy is one of the long-term and common complications of diabetes due to high levels of glucose in the body. Metformin as a biguanide, the most effective drug for treating patients with type 2 diabetes in the worldwide and reduces hyperglycemia in animal and human models. Recently, the drug has also been used to improve fertility and weight loss in patients with polycystic ovary syndrome. Beside these beneficial effects, excessive consumption and long-term of metformin may cause lactic acidosis in some cases. This paper highlighted beneficial and adverse effects of metformin in the kidney.

Keywords: Diabetes, Metformin, Kidney disease, Hyperglycemia, Diabetic nephropathy, end-stage renal failure

Materials and Methods
For this paper, we used a variety of sources including, Web of Science, PubMed, Embase, Scopus and directory of open access journals (DOAJ). The search was performed by using combinations of the following keywords and or their equivalents; chronic kidney disease, diabetes mellitus, hypertension, acute kidney injury, type 2 diabetes, end-stage renal disease, kidney.

Introduction
Biguanides refer to colorless and soluble compounds that include metformin, phenformin, and buformin. Among the biguanides, metformin (N, N-dimethylbiguanide) derived from galegine, widely has been used in the treatment of diabetic patients in the worldwide. They have various properties such as antioxidant, anti-inflammatory and anti-atherogenic effects (Figure 1). Around 70% of metformin is absorbed via the small intestine and after transport to the liver, is excreted by the kidneys. It has been shown that metformin levels are low in plasma and typically, in the range of 8 to 24 μmol/L (1,2). This drug administered for various diseases, such as diabetes, cancer, and polycystic ovary syndrome (PCOS) too. For example, the results of several investigations have shown that metformin can be safety in gestational diabetes mellitus (GDM) through reducing insulin resistance which leads to decrease abortion in this patients (3).

Recently, the several of studies have revealed that the use of metformin leading to inhibition of various cancer cells growth via molecular pathways such as suppress mTORC1 pathway (4). In addition, this compound affects renal functions by several pathways that this paper has discussed on this subject.

Metformin and kidney
Metformin as an antidiabetic drug inhibits hepatic gluconeogenesis through reducing the activity of the gluconeogenic key enzymes and the conversion of glycerol to glucose in following decreasing ATP in the hepatocytes. In conclusion, this antidiabetic drug leading to inhibition of gluconeogenesis and lipid/cholesterol synthesis. In general, metformin can affect hepatic lipid metabolism by regulation of circadian clock, alteration of autophagy, improvement of hepatic steatosis, and suppression of liver inflammation. This drug plays a beneficial role in renal dysfunction and can reduce
Renal disorders are considered one of the most common complications of diabetes. Metformin is the most drug widely used to treat type 2 diabetes through reducing the blood glucose concentration and other mechanisms. However, patients should be more cautious about consumption this medication and more investigation target on the current topic.

Conclusion
Renal disorders are considered one of the most common complications of diabetes. Metformin is the most drug widely used to treat type 2 diabetes through reducing the blood glucose concentration and other mechanisms. However, patients should be more cautious about consumption this medication and more investigation target on the current topic.

Author’s contribution
BY is the single author of the paper.

Conflicts of interest
The author declare no conflict of interest.

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