Management of hypertension in patients with type 2 diabetes mellitus

Mashitisho MLI, BSc(Med), MBChB, MMed(Int), HDip(Int)(SA), FCP(SA)
Department of Internal Medicine, University of Limpopo (Medunsa Campus)
Correspondence to: MLI Mashitisho, e-mail:bmashitisho@yahoo.com
Keywords: management, hypertension, type 2 diabetes mellitus

Abstract

Hypertension and diabetes co-exist. The prevalence of hypertension is higher in patients with type 2 diabetes mellitus, while patients with hypertension have a higher incidence of developing type 2 diabetes mellitus. Hypertension in patients with diabetes is linked to cardiovascular disease, strokes, the progression of renal disease and diabetic retinopathy. Any 10 mmHg drop in blood pressure is associated with a reduction in the rate of diabetes- related mortality by 15%, myocardial infarction by 11% and microvascular complications of retinopathy or nephropathy by 13%. According to the Society for Endocrinology, Metabolism and Diabetes of South Africa, target blood pressure in patients with hypertension and diabetes is between 120/70 mmHg and 140/80 mmHg. Different studies have demonstrated that adequate blood pressure control improves outcomes, especially strokes, when the blood pressure target is achieved. The United Kingdom Prospective Diabetes Study (UKPDS) 38 reported that tight blood pressure control in patients with type 2 diabetes mellitus reduced the risk of diabetes-related deaths, complications related to diabetes, progression to diabetic retinopathy and deterioration in visual acuity. Tight blood pressure control in patients with type 2 diabetes mellitus also reduces the costs of complications. In UKPDS 39, it was found that by preventing diabetes-related complications in patients with hypertension, the choice of antihypertensive drugs to control blood pressure was less important than the blood pressure control. It is very important for clinicians to be familiar with the different classes of drugs that are commonly used to control hypertension in patients with type 2 diabetes mellitus. This information will assist clinicians to prevent or delay the progression of diabetic complications. The drug classes that are commonly used in the management of hypertension in patients with diabetes mellitus are angiotensin-converting enzyme inhibitors, calcium-channel blockers, angiotensin II-receptor blockers, thiazide diuretics and beta blockers.

Ⓟ **Peer reviewed. (Submitted: 2012-06-09. Accepted: 2013-01-14.)** **S Afr Fam Pract 2012;55(1):41-44**

Introduction

Hypertension is more common in patients with type 2 diabetes mellitus,[1] and is associated with macrovascular and microvascular complications in such patients.[2] Patients with hypertension and type 2 diabetes mellitus can complicate to ischaemic heart disease, heart failure, recurrent cerebrovascular accident and chronic kidney disease. The United Kingdom Prospective Diabetes Study demonstrated that each 10 mmHg drop in blood pressure was found to be associated with a reduction in the rate of diabetes-related mortality (15%), myocardial infarction (11%) and microvascular complications of retinopathy or nephropathy (13%).[1,2] Tight blood pressure control in patients with type 2 diabetes mellitus reduces the risk of diabetes-related deaths, complications that relate to diabetes, progression to diabetic retinopathy and deterioration in visual acuity.[2] Tight blood pressure control reduces the costs of complications in patients with type 2 diabetes mellitus.[3] Therefore, it is important to control blood pressure to target in patients with diabetes mellitus as this will help to prevent complications. According to the Society for Endocrinology, Metabolism and Diabetes of South Africa, the target blood pressure for patients with diabetes and hypertension is between 120/70 mmHg and 140/80 mmHg.[4] Usually, to achieve this, the use of two or more drugs is required.[1,5] It is important for clinicians to be familiar with the drug classes that are employed to control blood pressure in patients with hypertension and diabetes mellitus.

Angiotensin-converting enzyme inhibitors

This class of drugs is recommended to form the backbone of the regimen that is used to treat hypertension in patients with diabetes mellitus.[1,2,6]

Angiotensin-converting enzyme (ACE) inhibitors prevent or delay cardiovascular complications in patients with hypertension and diabetes.[7] ACE inhibitors delay

progression to overt nephropathy in patients with microalbuminuria.[7] Compelling indications for the use of this drug class include the presence of microalbuminuria, chronic kidney disease, heart failure, ischaemic heart disease and cerebrovascular accident: all complications that are associated with hypertension and type 2 diabetes mellitus.[1,8] ACE inhibitors reduce plasminogen activator inhibitor-1 and thus have antiatherogenic effects beyond blood pressure control.[9] Angiotensin-receptor blockers (ARBs) can be used as an alternative drug class[1] in patients who have contraindications to ACE inhibitors, such as a history of angioedema and an ACE inhibitor-associated persistent dry cough.[10] ACE inhibitors and ARBs can be used interchangeably in patients with type 2 diabetes mellitus and nephropathy.[8]

Thiazide diuretics

Thiazide diuretics are beneficial in patients with diabetes and hypertension.[11,12] This drug class is used in combination with ACE inhibitors, calcium-channel blockers, beta blockers and ARBs to achieve blood pressure control.[1] Compelling indications for this drug class include heart failure, coronary heart disease and strokes.[1] Thiazide diuretics, when combined with the beta blocker, atenolol, may worsen hyperglyceamia and thus glyceamic control should be closely monitored when these agents are used together.[13,14] Thiazide diuretics reduce cardiovascular events by 34% when compared to placebo.[1]

Calcium-channel blockers

This drug class is useful in the reduction of blood pressure. Calcium-channel blockers can be used in addition to ACE inhibitors, angiotensin-receptor blockers, thiazide diuretics and beta blockers to lower blood pressure.[12] When amlodipine was compared with fosinopril in the fosinopril versus amlodipine comparative study, patients on amlodipine experienced more cardiovascular events.[9] In another study in which nisoldipine was compared with enalapril in cardiovascular outcomes in patients with diabetes mellitus and hypertension, patients on nisoldipine had a higher incidence of fatal and nonfatal myocardial infarctions, compared with those assigned to enalapril.[15,16] Other studies found that certain calcium-channel blockers, such as the nondihydropyridines class of calcium-channel blockers, had reno- and cardioprotective effects.[2,6,7,17] When a calcium-channel blocker was added to another drug class for hypertension control, it had the same effect on lowering blood pressure as other drug classes.[12] Nifedipine should be avoided in short-acting preparations as it was shown to increase cardiovascular mortality.[18]

When the renoprotective effects of the dihydropyridine calcium-channel blockers drug class were compared with those of the nondihydropyridine calcium-channel blocker drug class, dihydropyridine calcium-channel blockers worsened renal function in patients with diabetic kidney disease. Therefore, it is recommended that this drug class is not used in combination with ARBs or ACE inhibitors.[8] Compelling indications for the use of calcium-channel blockers are in patients with angina not responding to beta blockers, and as an additional drug to ACE inhibitors, ARBs, diuretics and beta blockers in patients with diabetes and hypertension.[1]

Beta blockers

Beta blockers are another drug class used to treat hypertension. This drug class is also important in treating patients with coronary heart disease, heart failure and post myocardial infarction. Beta blockers may be used with other drug classes in the treatment of hypertension. Their value as monotherapy in the treatment of hypertension in patients with diabetes is not clear.[1] Their antihypertensive effects are the same as those of other drug classes. Beta 1 selective drugs are preferred to nonselective beta adrenergic blockers in the treatment of hypertension in patients with type 2 diabetes mellitus.[1] Beta blockers can impair the recognition of the adrenergic effects of hypoglycemia in patients with diabetes mellitus. Nonselective beta blockers are likely to have this effect.[14] Atenolol causes hyperglycaemia and may lead to new onset type 2 diabetes mellitus and difficulty in controlling diabetes mellitus.[13]

Conclusion

Hypertension and type 2 diabetes mellitus usually co-exist. Management of hypertension includes lifestyle changes, weight reduction, exercise, diet and pharmacotherapy.

The pharmacotherapy of hypertension in patients with type 2 diabetes mellitus commonly involves two or more drug classes. ACE inhibitors should form the backbone of the drug regimen that is used to treat hypertension in patients with diabetes mellitus. Angiotensin-receptor blockers should be the first line of treatment, in combination with other drug classes, for patients with diabetic nephropathy. Angiotensin II-receptor blockers may be used as an alternative drug class for patients where ACE inhibitors are contraindicated. Add-on drug classes include thiazide diuretics, calcium-channel blockers and beta blockers.

References

1. Chobanian AV, Bakris AJ, Black HR, et al. The seventh report of the joint National Committee on Prevention, Detection, Evaluation and treatment of High Blood Pressure: the JNC 7 report. JAMA. 2003;289(19):2560-2572.
2. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. BMJ. 1998;317(7160):703-713.
3. Cost effectiveness analysis of improved blood pressure control in hypertensive patients with type 2 DM: UKPD 40. UK Prospective Diabetes Study Group. BMJ.1998;317(7160):720-726.
4. Society for Endocrinology, Metabolism and Diabetes of South Africa. The 2012

SEMDSA guidelines for the management of type 2 diabetes. JEMDSA. 2012;17(2) (Supplement 1):S1-S95.

5. Efficacy of atenolol and captopril in reducing risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 39. UK Prospective Diabetes Study Group. BMJ. 1998;317(7160):713-720.
6. American Diabetes Association. Treatment of hypertension in adults with diabetes. Diabetes Care. 2003;26:80-82.
7. Effects of ramipril on cardiovascular and microvascular outcomes in people with diabetes mellitus: results of the HOPE Study and MICRO-HOPE sub-study. Lancet. 2000;355(9200):253-259.
8. National Kidney Foundation KDOQI clinical practice guidelines and clinical practice recommendations for diabetes and chronic didney disease, guideline 3: management of hypertension in diabetes and chronic kidney disease. National Kidney Foundation [homepage on the Internet]. Available from: www.kidney.org/professionals/kdoqi/guideline_diabetes/guide3.htm
9. Marco P, Lonneke VF, Steven RD, et al. Fosinopril versus amlodipine comparative treatments study: a randomized trial to assess effects on plasminogen activator inhibitor-1. Circulation. 2002;105(4):457-461.
10. Carlos AP, Marian AP, Phillip R. The treatment of hypertension in adult patients with diabetes. Diabetes Care. 2002,25;134-147.
11. The ALLHAT Officers and Coordinators for the ALLHAT Collaborative Research Group, The Antihypertensive and Lipid-lowering Treatment to prevent Heart Attack Trial. Major outcomes in high-risk hypertensive patients Randomized to angiotensin-converting enzyme inhibitor or calcium channel blocker vs. diuretic; the Antihypertensive and Lipid-lowering Treatment to prevent Heart Attack Trial (ALLHAT) JAMA.2002;288(23);2981-2997.
12. PROGRESS Collaborative Group. Randomized trial of a perindopril-based blood pressure-lowering regimen among 6105 individuals with stroke or transient ischemic attack. Lancet. 2001;358(9287):1033-1041.
13. Opie LH, Schall R. Old antihypertensives and new diabetes. J Hypertens. 2004;22(8):1453-1458.
14. Mason J, Dickinson H, Nicolson D, et al. The diabetogenic potential of thiazide diuretics and beta blocker combination in the management of hypertension. J Hypertens. 2005;23(10):1777-1781.
15. Alvin CP. Diabetes mellitus. In: Longo DL, Fauci AS, Kasper DL, editors. Harrison's principles of internal medicine. 18th ed. New York: McGraw-Hill, 2012; p. 2968-3003.
16. Raymond O, Estacio MD, Barrett W, et al. The effects of nisoldipine as compared with enalapril on cardiovascular outcomes in patient with non-insulin-dependent diabetes and hypertension. N Engl J Med. 1998;338(10):645-652.
17. Comparison between perindopril and nifedipine in hypertension and normotensive diabetic patients with microalbuminuria. Melbourne Diabetic Nephropathy Study Group. BMJ. 1991;302(6770):210-216.
18. Anne PH, Ruchi M. Complications of diabetes mellitus: primary care implications. In: Christine AB, William H, Francine RK, editors. Davidson's diabetes mellitus: diagnosis and treatment. 5th ed. United States: Saunders, 2004; p. 189-238.