Original Article

Effects of captopril vs amlodipine on blood pressure, serum glucose and lipid profile in overweight and obese hypertensive patients

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Objectives: To investigate the effects of captopril vs amlodipine on blood pressure, BMI, serum glucose concentration and lipid profile in overweight and obese hypertensive patients.
Methodology: This study was conducted on two groups of overweight and obese newly diagnosed stage 1 hypertensive patients; captopril group included 42 patients who were kept on captopril monotherapy and amlodipine group included 41 patients who were kept on amlodipine monotherapy. Another 40 apparently healthy normotensive individuals were used as a control group. The patients were placed on captopril or amlodipine for 8 weeks. Systolic and diastolic BP, body weight, BMI, fasting serum glucose and lipid profile were measured before and at the end of trial.
Results: After 8 weeks of treatment with captopril or amlodipine the measured parameters are significantly reduced but comparison of each group revealed no significant differences except for Fasting Glucose, where a higher reduction was seen with captopril.
Conclusion: Both captopril and amlodipine were effective in the treatment of hypertension in overweight and obese patients. In addition, both drugs had beneficial effects on body weight, serum glucose concentration and lipid profile. (Rawal Med J 2013;38:104-108).
Key words: Overweight, obesity, hypertension, captopril, amlodipine.

INTRODUCTION

Excess weight gain is a major cause of increased blood pressure in most patients with essential hypertension and greatly increases the risk for renal diseases.[1] The relationship between obesity and hypertension is not straight forward, and most likely represents the interaction of demographic, genetic, hormonal, renal and hemodynamic factors in the overweight and obese patients.[2]

In addition to increasing blood pressure, overweight and obesity affect the metabolism of glucose and lipids. Njelekela et al. reported that, compared to lean subject, obese men and women had significantly higher mean triglyceride, total cholesterol and LDL-cholesterol.[3] Stevens et al.[4] showed that around 90% of individuals who develop type 2 diabetes have BMI higher than 23.0 kg/m^2. Treatment of hypertension in overweight and obese patients can be done by non pharmacological and pharmacological means. Non pharmacological treatment involves weight loss.[5] Weight reduction helps pharmacological treatment.[6,7] Consequently, lifestyle modification is the cornerstone of management in all patients with prehypertension or with the metabolic syndrome, but if BP exceeds 140/90 mmHg, pharmacological therapy is indicated.[8]

Drugs used for the treatment of hypertension should have no harmful effects on the metabolic processes of the body e.g. diuretics and B-blockers have unfavorable effects on lipid and glucose metabolism leading to increased levels of glucose and lipids in the blood.[9,10] Zhang et al.[11] reported that the use of a combination of nitrendipine and atenolol in hypertensive patient having BMI > 25 Kg/M^2 may significantly increase body weight and fasting blood glucose in this group of overweight and obese patients.[11] The aim of this study was to investigate the effects of captopril vs amlodipine on blood pressure, BMI, serum glucose concentration and lipid profile in overweight and obese hypertensive patients.

METHODOLOGY

This open, controlled comparative clinical trial study was conducted over a period of 9 months from September, 2009 to June, 2010 at Al-Salam Teaching Hospital, Mosul city, Iraq. The protocol

was approved by the regional research committees at the College of Medicine and Mosul Health administration. Inclusion criteria included overweight and obese (BMI > 25 kg/m^2), newly diagnosed stage 1 hypertensive patients. Exclusion criteria included patients already on antihypertensive therapy or any drug that affect BP, patients with a history of hepatic, cardiac or renal diseases, patients having hypersensitivity to ACEIs or CCBs, patients with stage 2 hypertension and pregnant or lactating women.

A total of 83 patients were enrolled in this study and were divided into 2 groups; the first group included 42 patients on captopril monotherapy and the second group included 41 patients on amlodipine monotherapy. Forty apparently healthy normotensive individual with BMI<25 kg /m^2 were included as a control group. Captoril was given in a dose of 25 to 50 mg twice to thrice daily and amlodipine was given in a dose of 5 to 10 mg/day for 8 weeks in both groups. Data were collected from each individual before and at the end of the trial including systolic and diastolic BP, body weight, BMI, fasting serum glucose and lipid profile.

Analysis of variance (ANOVA) was used to determine variation of age among the 3 groups. Paired t-test was used to compare data before and after drug therapy. Unpaired t-test was used for the comparisons between data of the control with the baseline data of both groups, and the percentage variations between amlodipine and captopril groups. Results considered significant at p? 0.05.

RESULTS

There were no statistically significant differences between the studied groups regarding age and gender. There were highly significant differences between the parameters of captopril or amlodipine groups at baseline in comparison to control group (Tables 1 and 2). The measured parameters were significantly reduced after 8 weeks of therapy (Tables 3 and 4). Three groups were age matched having mean age of 50.00±8.1 years, 49.31±8.9 years and 49.98±8.8 years for amlodipine, captopril and control groups, respectively, which are statistically not significant (P=0.56).

Table 1. Baseline demographics in captopril group (Mean±SD).

Parameter	Captopril (N=42)	Control (N=40)	P value
Systolic BP mmHg	146.76±6.58	122.5±6.5	< 0.001
Diastolic BP	93.33±3.61	80.13±5.1	< 0.001
BMI kg/m^2	30.15±2.49	22.43±1.97	< 0.001
FSG mmol/L	6.01±0.99	5.26±0.85	< 0.001
Total-cholesterol	5.86±0.98	5.13±0.92	< 0.001
Triglyceride	2.16±0.78	1.75±0.66	< 0.05
LDL-cholesterol	3.90±0.93	3.06±0.75	< 0.001
HDL-cholestrol	1.02±0.21	1.30±0.26	< 0.001
Atherogenic index	5.91±1.36	4.01±0.71	< 0.001

Three groups were also gender matched having 19, 22, and 20 males and 22, 20, and 20 females for amlodipine, captopril and control groups, respectively, which are statistically not significant (P=0.86).

Table 2. Baseline demographics in amlodipine group (Mean±SD).

Parameter	Amlodipine (N=41)	Control (N=40)	P value
Systolic BP mmHg	148.78±6.1	122.5±6.5	< 0.001
Diastolic BP	94.51±3.5	80.13±5.1	< 0.001
BMI kg/m^2	32.84±3.9	22.43±1.97	< 0.001
FSG mmol/L	6.03±0.99	5.26±0.85	< 0.001
Total-cholesterol	5.91±0.93	5.13±0.92	< 0.001
Triglyceride	2.12±0.79	1.75±0.66	< 0.05
LDL-cholesterol	3.85±0.85	3.06±0.75	< 0.001
HDL-cholestrol	1.07±0.23	1.30±0.26	< 0.001
Atherogenic index	5.76±1.43	4.01±0.71	< 0.001

Table 3. Parameters of captopril group at baseline and after 8 weeks (Mean±SD).

Parameter	Captopril Group (Baseline) N=42	Captopril Group (After 8 weeks)	P value
Systolic BP mmHg	146.76±6.58	131.55±9.27	< 0.001
Diastolic BP	93.33±3.61	81.07±5.13	< 0.001
BMI kg/m^2	30.15±2.49	29.26±2.73	< 0.001
FSG mmol/L	6.01±0.99	5.23±0.68	< 0.001
Total-cholesterol	5.86±0.98	5.11±0.84	< 0.001
Triglyceride	2.16±0.78	1.83±0.65	< 0.001
LDL-cholesterol	3.90±0.93	3.19±0.89	< 0.001
HDL-cholestrol	1.02±0.21	1.10±0.26	< 0.008
Atherogenic index	5.91±1.36	4.83±1.38	< 0.001

The number of patients achieved normal systolic BP after therapy with captopril or amlodipine were 31 (74%) for captopril and 25 (61%) for amlodipine (P=0.21). For diastolic BP, the number of patients achieved normal diastolic BP after therapy with captopril or amlodipine were 35 (83%) and 34 (83%) respectively, (P=0.96).

Table 4. Parameters of amlodipine group at baseline and after 8 weeks.

Parameter	Amlodipine Group (Baseline) N=41	Amlodipine Group (After 8 weeks)	P value
Systolic BP mmHg	148.78±6.10	134.27±7.9	< 0.001
Diastolic BP	94.51±3.50	81.95±5.90	< 0.001
BMI kg/m^2	32.84±3.90	32.02±3.80	< 0.001
FSG mmol/L	6.03±0.99	5.55±0.76	< 0.001
Total-cholesterol	5.91±0.93	5.28±0.84	< 0.001
Triglyceride	2.12±0.79	1.84±0.69	< 0.001
LDL-cholesterol	3.85±0.85	3.27±0.86	< 0.001
HDL-cholestrol	1.07±0.23	1.18±0.25	< 0.001
Atherogenic index	5.76±1.43	4.65±1.23	< 0.001

Comparison of the percent variation of the studied parameters of captopril group and those of amlodipine group revealed no significant differences except for fasting glucose, where a higher reduction was obtained with captopril (Table 5).

Table 5. Comparison of parameters on captopril and amlodipine (Mean±SD).

Parameter	Amlodipine (N=41)	Captopril (N=42)	P value
Systolic BP mmHg	-9.64±5.83	-10.33±5.49	0.28
Diastolic BP	-13.21±6.63	-13.05±5.94	0.46
BMI kg/m^2	-2.49±2.02	-3.00±2.96	0.18
FSG mmol/L	-7.31±7.58	-11.93±10.06	0.011
Total-cholesterol	-10.38±7.34	-11.81±13.05	0.27
Triglyceride	-11.03±27.57	-12.75±21.24	0.375
LDL-cholesterol	-14.69±13.75	-16.17±20.72	0.175
HDL-cholestrol	11.22±16.88	9.14±18.91	0.3
Atherogenic index	-18.51±11.6	-18.09±14.27	0.442

DISCUSSION

Therapy with captopril or amlodipine for a period of 8 weeks demonstrated a significant reduction of both systolic and diastolic BP. In addition, a considerable number of patients had achieved goal BP of less than 140/ 90 mmHg indicating that both drugs are effective in treating overweight and obese hypertensive patients.

Earlier studies described some pathophysiological abnormalities associated with hypertension in obese patients, such as renin dependency,13 sodium retention, a characteristic of salt sensitivity, increased extracellular fluid volume, elevated cardiopulmonary volume and increased cardiac output.14 Both cardiac output and total peripheral resistance are elevated in obesity and both impose a load on the left ventricle, resulting in both a volume and a pressure overload left ventricular hypertrophy.15

The primary mechanism of action of captopril is selective control of BP through blockade of the RAAS,16 and may, through dilating the efferent glomerular arterioles, restore the ability of the kidney to excrete salt and water as well as control glomerular hyperfiltration.17 Amlodipine reduced BP By reducing peripheral vascular resistance by antagonizing the effect of calcium on the smooth muscles of the peripheral blood vessels. In addition, amlodipine like nifedipine, can cause natriuresis and diuresis resulting in a long lasting loss of sodium and water18 and like captopril, the fall in vascular resistance is associated with reduced left ventricular mass and preserved cardiac and renal function.15

In addition to the risk of hypertension, obesity further enhances cardiovascular risk by increasing LDL-Cholesterol levels, reducing HDL-cholesterol levels, diminishing glucose tolerance and predisposing to the development of left ventricular hypertrophy.19,20 In addition to lowering BP, antihypertensive drugs used in obese hypertensive patients should have at least no deleterious effects on the above mentioned abnormalities which accompanied obesity.

In the present study, both captopril and amlodipine caused a significant reduction of the BMI. Ersoy et al demonstrated that amlodipine therapy in a number of obese hypertensive type 2 diabetic patients for 12 weeks resulted in a non significant reduction of BMI of the patients from 31±1.1 to

30.5±1.0.21 ACE deficiency leads to reduction in body fat accumulation in mice and suggests that drugs that affect the RAS such as ACEIs might spark weight loss.22 In addition, Cooper et al.23 showed that serum ACE and circulating angiotensinogen levels were significantly higher in obese individuals. Thus, drugs that block RAAS may reduce the levels of RAAS components and may reduce the body weight and hypertension of obese patients.

In the present study both captopril and amlodipine had beneficial effects on serum glucose of the patients. This may be due to the fact that calcium channel blockers cause vasodilatation and improve peripheral blood flow and insulin sensitivity24 or by reducing the level of tumor necrosis factor-a (TNF-a) which suggested to play a key role in insulin resistance in obesity.21 Captopril improved glycemic control and improving insulin sensitivity by enhancing blood flow to skeletal muscle and other tissues25 or by inhibition of adrenergic activity which impairs insulin secretion and glucose uptake.26 Both captopril and amlodipine had beneficial effects on serum lipid profile of the patients. This is in line with other previous studies that also reported beneficial effects of captopril or amlodipine on lipid profile.21

CONCLUSION

This study demonstrated that both captopril and amlodipine were effective agents in the treatment of hypertension in overweight and obese patients. In addition, both drugs had beneficial effects on body weight, serum glucose concentration and lipid profile.

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