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A Review on the Role of Hypertension in the Metabolic Syndrome

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Abstract: The metabolic syndrome significantly elevates the risk of cardiovascular disease and renal damage. Because of the relationships among different components of metabolic syndrome, it is difficult to understand the cause of these diseases. Blood pressure is one of the most factors of cardiovascular risk and disease. Hypertension is in many cases underrated and undiagnosed. It is suggested that there are different mechanisms to play a role in the blood pressure elevation in different subjects. Elevated blood pressure is believed a significant component of metabolic syndrome. Individuals with metabolic syndrome have been shown increased blood pressure or hypertension. It is reported that metabolic syndrome expand hypertension related cardiac and renal damage. The treatment of subjects with the metabolic syndrome is important to decrease the risk of cardiovascular and renal diseases, diabetes and hypertension and organ damage in the future. In present study, it was reviewed with a number of related articles on the role of hypertension (as one of the metabolic syndrome components) in metabolic syndrome.

Key words: Hypertension, metabolic syndrome, disease

INTRODUCTION

There are many definitions for metabolic syndrome. The metabolic syndrome is described by obesity, high blood glucose, low level of high-density lipoprotein (HDL), high triglyceride, and high blood pressure. These are risk factors for cardiovascular disease (CVD) (Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults, 2001). Several definitions of Metabolic Syndrome described in the World Health Organization's (WHO) decided to make to standardize the criteria. The National Cholesterol Education Program (NCEP) suggested the concept of Metabolic Syndrome (Shepherd *et al.*, 1995).

The Third Report of the National Cholesterol Education Program Adult Treatment Panel (ATP III) introduced a definition in 2001. ATP III is the most used definition in many studies. Subjects have taken in account having metabolic syndrome if they had any three or more of the following, according to the ATP III Criteria: (Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults, 2001):

- Abdominal obesity: Waist Circumference higher than 102 and 88 cm in males and females, respectively
- Hypertriglyceridemia: Serum triglycerides level more than 150 mg dL⁻¹
- Low HDL-cholesterol: Serum HDL-cholesterol lower than 40 and 50 mg dL⁻¹ in males and females, respectively

- High blood pressure: SBP higher than 130 mmHg and DBP higher than 85 mmHg or on treatment for hypertension
- High fasting glucose: Serum glucose level higher than 110 mg dL⁻¹ or on treatment for diabetes

Many studies have been approved the importance of the metabolic syndrome in different populations as a predictor of vascular disease (Shepherd *et al.*, 1995; Downs *et al.*, 1998; Ballantyne *et al.*, 2001). Several studies have been shown that the metabolic syndrome is one of the significant public health problems in the World. The prevalence of metabolic syndrome alternates in different ethnic groups (Meigs *et al.*, 2003; Cameron *et al.*, 2004; King and Zimmet, 1998). There are many factors that can affect the metabolic syndrome prevalence and its components such as ethnic differences, regimen, physical activity, age and sex (Cameron *et al.*, 2004). One of the main causes of death among women in the world is cardiovascular disease (Lloyd-Jones *et al.*, 2009). Studies among Italian, Korean, Chinese and Iranian populations have been shown that prevalence of metabolic syndrome were 3-3.5% (Trevisan *et al.*, 1998), 13.8% (Kim *et al.*, 2007), 17.8% (Gu *et al.*, 2005) and 18.35% (Eshtiaghi *et al.*, 2010) for females, respectively. The frequency of metabolic syndrome among Fars and Sistani females were 20.62% and 23.75%, respectively (Marjani *et al.*, 2012; Marjani *et al.*, 2012). Studies in Greece and USA

have shown that prevalence of metabolic syndrome was similar in both gender (males and females) (Athiros *et al.*, 2005; Cameron *et al.*, 2004). Some studies indicated that females to be much more frequently affected (Cameron *et al.*, 2004; Ramachandran *et al.*, 2003), while in some other studies the metabolic syndrome was found to be more common among males (Ramachandran *et al.*, 2003). The prevalence of metabolic syndrome depended on age progresses. In a study in Turkey, it has been shown that the prevalence of metabolic syndrome changes in different age groups. It was shown that the prevalence of the metabolic syndrome was 15.3, 23.1, 28.0, 26.0 and 20.5% among people aged from 30 to 39, 40 to 49, 50 to 59, 60 to 69, 70 to 79 and ≥ 80 years old, respectively (Sanisoglu *et al.*, 2006). In other study in US, it has been reported that the prevalence of the metabolic syndrome was 16.5, 40.3 and 46.4% for males and 19.1, 33.8 and 56.0%, respectively, for females aged from 20 to 39, 40 to 59 and ≥ 60 years old, respectively. It was found that there is an association between older age groups and a higher prevalence of metabolic syndrome (Ford *et al.*, 2006). One of the most effective determining factors of cardiovascular risk and disease is blood pressure. Hypertension is in many cases underrated and undiagnosed. It is suggested that there are different mechanisms to play a role in the blood pressure elevation in different subjects. Many studies have been shown that the metabolic syndrome confers an elevated risk of cardiovascular disease and mortality (Lakka *et al.*, 2002; Ridker *et al.*, 2003; Sattar *et al.*, 2003; Isomaa *et al.*, 2001). It has been revealed that the metabolic syndrome may be increased in hypertensive patients (Schillaci *et al.*, 2004). It seems that the association between increased cardiovascular risk and metabolic syndrome may be depended on an elevated incidence of preclinical cardiovascular and renal alterations in hypertension and metabolic syndrome patients (Isomaa *et al.*, 2001; European Society of Hypertension, ESH-ESCGC, 2003; Vakili *et al.*, 2001; Cerasola *et al.*, 1996; Karalliedde and Viberti, 2004). Study of Reaven *et al.* (1996) have been shown that metabolic alterations may play in the blood pressure regulation. Many studies have indicated that there is an association between insulin resistance and blood pressure (Every *et al.*, 1993; Manolio *et al.*, 1990; Chen *et al.*, 1995) and some other studies were not in agreement with these findings (Dowse *et al.*, 1993; Collins *et al.*, 1990; Muller *et al.*, 1993). Some findings have been shown that there is an association between the metabolic syndrome and hypertension in 50% of patients (Reaven *et al.*, 1996). Ethnic variations in the association between the metabolic syndrome and hypertension have been shown in many studies (Ferrinin *et al.*, 1987; Shen *et al.*, 1988;

Howard *et al.*, 1996; Pollare *et al.*, 1990; Edwards *et al.*, 1998). Some studies have indicated that there are different relationships between the metabolic syndrome and hypertension in people who live in different areas, but their ethnicity is the same (Manolio *et al.*, 1990; Chen *et al.*, 1995; Zimmet *et al.*, 1994). In present study, it was reviewed with a number of related articles on the role of hypertension (as one of the metabolic syndrome components) in metabolic syndrome.

DIFFERENT OBSERVATIONS

The metabolic syndrome is highly frequent worldwide. It can be seen in nearly one-third of patients with hypertension. The metabolic syndrome significantly elevates the risk of cardiovascular disease and renal damage. Because of the relationships among different components of metabolic syndrome, it is difficult to understand the cause of these diseases. It has been identified that obesity and insulin resistance may play a significant role in the elevation of blood pressure and the progression of hypertension. In spite of the fact that its exact mechanisms are not completely clear. More than 80% of individuals with the metabolic syndrome have shown a blood pressure in the high normal or hypertension. Studies have shown that patients with metabolic syndrome have a 5.5-fold risk of diabetes and 2-fold risk of hypertension when compared with subjects without metabolic syndrome (Franklin, 2005). Some studies have shown the relationship of the high prevalence of blood pressure abnormalities in the metabolic syndrome and incidence of organ damage (Mancia *et al.*, 2007). These studies have shown that all components of the metabolic syndrome donate to elevated blood pressure. This can promote cardiac, renal and brain tissue damages (Khan *et al.*, 2007; Reaven, 2001). The importance of hypertension depends on as risk factors in the progression of cardiovascular disease and the main cause of morbidity and mortality. Hypertension often stays undiagnosed. It may cause kidney damage and heart failure (Kearney *et al.*, 2005). The association of elevated blood pressure and metabolic abnormalities has been identified long time before the metabolic syndrome be approved (Kannel, 1996). Before 1997, hypertension was explained if blood pressure value was above 160/90 mmHg. The definition of hypertension alters if an elevation in systolic or diastolic blood pressure of 5 mmHg occur, which is associated with an elevation in cardiovascular disease (Kannel, 1995). In 1997, the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure suggested a value of 140/90 mmHg for the

general population and 130/85 mmHg for diabetic subjects JNC, 1997). In 2003, this committee suggested a value of 130/80 mmHg for diabetic patients (Chobanian *et al.*, 2003). In 2003, the European Society of Hypertension and Cardiology also mentioned a new definition of blood pressure as a value under 120/80 mmHg (GC, European society of hypertension, ESH-ESCGC (2003). Choi *et al.* (2003) have been shown that blood pressure was not related to other cardiovascular disease risk factors. Study of Saad *et al.* (1991) indicated that there is an association between blood pressure and insulin resistance among different ethnic groups. In the study of Chen *et al.* (1995) on Chinese people have shown that hypertension was linked to the metabolic syndrome in females. Vazquez *et al.* (2003) reported that 62% hypertensive patients were seemed to have metabolic syndrome. Schillaci *et al.* (2004) have found that metabolic syndrome is a useful index for detection of future cardiovascular disease in hypertensive patients. Their results have been shown that metabolic syndrome increases cardiovascular disease risk in hypertensive patients. In a study has been shown that the prevalence of metabolic abnormalities collaborated with hypertension in two control and hypertensive groups (0.8 to 35.3%, respectively). Most of the hypertensive patients (Approximately 91.3%) have shown one associated cardiovascular risk factor (Rantala *et al.*, 1999). There is an association between the metabolic syndrome and the risk of diabetes mellitus and cardiovascular disease. The prevalence of metabolic syndrome in Japanese type 2 diabetic patients was 26.37%. It has been shown that the prevalence was higher in males than females (45.9, 28.0%, respectively) (Shimajiri *et al.*, 2008). A study indicated that the overall prevalence was 32.6% in Korean people. The prevalence was reported to be 46.9% in males and 65.1% in females (Kim *et al.*, 2008). The Saudi with type 2 diabetes has been shown that the overall prevalence was 22.64% (19.49 male, 25.17% female) (Ahmed, 2008). Reported that the prevalence of metabolic syndrome in type 2 diabetic patients was 53.27% in females and 48.71% in males. They have found that the prevalence of metabolic syndrome in Gorgan was significantly high when compared with findings (Marjani and Moujerloo, 2011). Diabetes mellitus and hypertension are interdependent diseases. Diabetes mellitus make people susceptible to cardiovascular disease (Epstein and Sowers, 1992; The National High Blood Pressure Education Program Working Group, 1994). A study has shown that patients with diabetes have a 2-fold risk of hypertension when compared with subjects without diabetes (The National High Blood Pressure Education Program Working Group, 1994). Genetic differences and lifestyle may be important factors in promoting to hypertension and diabetes mellitus in

different subjects. The prevalence of hypertension and diabetes seems to be elevating in developed countries. Studies have shown that the prevalence of hypertension and diabetes elevates with age (Mogensen, 1990; Mykkanen *et al.*, 1994). Hypertension causes diabetic retinopathy and blindness (The National High Blood Pressure Education Program Working Group, 1994). It is suggested to identify both hypertension and diabetes and treatment of subjects must begin quickly. Hypertension frequently causes the progress of nephropathy in many diabetic subjects (Mogensen, 1990; Mykkanen *et al.*, 1994).

CONCLUSION

One of the important components of metabolic syndrome is hypertension. Many studies suggested that metabolic syndrome expand hypertension related cardiac and renal damage. Hypertension is closely collaborated with the metabolic syndrome. The influence of blood pressure regulation on mortality and cardiovascular disease is important. It looks like to confer a higher cardiovascular risk on the top of the risk caused by blood pressure enhancement. Alterations in lifestyle in developed and developing countries cause the epidemic growth of overweight and obesity, metabolic abnormalities, diabetes mellitus, cardiovascular disease and death. The first therapeutic step suggestion is alterations in lifestyle. It is important to change dietary habit and elevates daily activation. Initiation of antihypertensive treatment is needed to reduce blood pressure levels. The aim of treatment of individuals with the metabolic syndrome is to decrease the high risk of cardiovascular and renal diseases, diabetes and hypertension and organ damage.

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