

**HIGH BLOOD PRESSURE AS A RISK FACTOR FOR THE DEVELOPMENT OF
MITRALREGURGITATION**

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ABSTRACT

According to WHO, blood pressure is defined as 'the force exerted by circulating blood against the walls of the body's arteries, the major blood vessels in the body'. High blood pressure or hypertension is a condition when blood pressure is high. High blood pressure is known as one of the risk factors for development of mitral regurgitation in patients with no known pre-existing cardiac disease. This article discusses about what is meant by high blood pressure, classification and aetiology of high blood pressure, what is mitral regurgitation and aetiology of mitral regurgitation, clinical features of mitral regurgitation, effect of high blood pressure on mitral valve and its components, and how high blood pressure can be a risk factor for the development of mitral regurgitation in a patient with no known cardiac disease. This also discusses appropriate steps to manage high blood pressure and also the preventive measures against the development of mitral regurgitation due to high blood pressure.

KEYWORDS: High blood pressure, Mitral regurgitation, Mitral valve, Primary hypertension, Secondary hypertension, Prehypertension, Hypertensive crisis.

INTRODUCTION

Blood pressure is the force exerted by circulating blood against the walls of the body's arteries, the major blood vessels in the body.^[1] It is represented or written as numerator and denominator. The numerator part is systolic pressure and the denominator part is diastolic pressure.

Systolic blood pressure is the maximum pressure in ventricles during contraction and diastolic pressure is the minimum pressure just before contraction of ventricles. The parameters that determine the blood pressure measured on brachial arteries are cardiac output and total peripheral resistance. The formula for mean arterial blood pressure (MAP) is (2):

$$MAP = \frac{2 DBP + SBP}{3}$$

DBP is diastolic blood pressure and SBP is systolic blood pressure.

Mean arterial blood pressure is useful in measuring the overall blood flow.^[2] This mean arterial pressure is used in calculation of cardiac output by the formula (2)

$$CO = \frac{MAP}{TPR} \times 80$$

TPR is total peripheral resistance and 80 is conversion factor. Hence, it's clear the increase in MAP comes as a

result of increased CO or TPR or both. The CO is also determined by the function of the left ventricle, which in turn is determined by the preload, musculature of ventricles, afterload and end diastolic volume.

Whereas the TPR is determined by the force produced by arteries when blood flows through it. Lately the high blood pressure or hypertension is defined as the systolic blood pressure 130 mmHg or more and diastolic blood pressure 80 mmHg or more.^[3] Hypertension has become one of the major reasons for the development of many comorbidities such as myocardial infarction, stroke and renal failure.^[4]

CLASSIFICATION OF HYPERTENSION

The classifications of hypertension are as follows:

- Prehypertension: Systolic blood pressure between 120-139 mmHg and diastolic blood pressure between 80-89 mmHg.^[5]
- Stage 1 hypertension: Systolic blood pressure 140-159 mmHg and diastolic blood pressure between 90-99 mmHg.^[5]
- Stage 2: Systolic blood pressure Greater than 160 mmHg and diastolic blood pressure above 100 mmHg.^[5]

This Pre-hypertension category was added in the JNC 7 report to point out that patients with prehypertension are at risk of developing hypertension and they require management and preventive measures.^[5]

On the other hand, the hypertension can be classified as primary(essential) or secondary hypertension

- Primary hypertension or essential hypertension is the most common hypertension. It is a condition of high blood pressure that can be multifactorial that is without a specific or identifiable secondary cause.^[3]
- Secondary hypertension: This occurs as a result of some other underlying disease.^[3] Blood pressure more than 180/120 mmHg is designated as hypertensive crisis. This may be further grouped into hypertensive emergencies in which there's target organ damage^[6] and hypertensive urgency where there is no organ damage. The end organ damages can be like cerebral vascular damage, myocardial ischemia, left ventricular failure and acute renal failure. Main cause of prehypertension in young individuals is due to increased cardiac output and, in the middle, aged it's due to increased vascular resistance.^[3]

This high output hypertension is due to retention of fluid and salt by kidneys. This often leads to increased stroke volume and stimulation of adrenergic activity. The progression of essential hypertension from prehypertension to complicated hypertension requires persistent long-term hypertension. The main causes of primary hypertension are age, high salt intake, Obesity, alcohol intake and sedentary lifestyle and sleep disorders whereas secondary hypertension is caused mainly by endocrinological diseases and renal-vascular diseases.

MITRAL REGURGITATION

Mitral regurgitation is defined as the backflow of blood from left ventricle to left atrium. Two types of mitral regurgitation are acute and chronic.^[7]

ACUTE MITRAL REGURGITATION

In Acute mitral regurgitation there is an increase in preload and end-diastolic volume, meanwhile afterload and end-systolic volume decreases. The overall result will be a decrease in forward stroke volume because of regurgitation of blood into the left atrium. This increase in left atrial pressure.

CHRONIC COMPENSATED MITRAL REGURGITATION

In this type the left atrium has sufficient time to dilate and accommodate regurgitated blood. Total stroke volume and forward stroke volume remains normal or slightly elevated because the left ventricle dilation is due to eccentric hypertrophy. As the left ventricle enlarges, mitral regurgitation and left ventricular dilation worsens.

CHRONIC DECOMPENSATED MITRAL REGURGITATION

This cardiac malfunction occurs affecting total stroke volume and forward stroke volume. This results in higher end systolic volume and end diastolic volume resulting in elevation of left atrial and ventricular pressure which in turn leads to pulmonary edema.

AETIOLOGY MITRAL REGURGITATION

The main causes of mitral regurgitation are myxomatous degeneration of connective tissue like mitral valve prolapse and myxoma.

Ruptured chordae tendineae, acute rheumatic fever, prosthetic valve dysfunction, mitral regurgitation due to enlargement of LV cavity and certain drugs are other causes of mitral regurgitation.

CLINICAL FEATURES OF MITRAL REGURGITATION SYMPTOMS

Patients with acute mitral regurgitation are usually asymptomatic.

Patients with chronic mitral regurgitation often present with Fatigue, breathless on exertion which increases in supine position and orthopnoea, hypotension and tachypnoea. Palpitations are not uncommon and may pave the way for Atrial fibrillation.

Auscultatory findings of Mitral regurgitation usually present with holosystolic murmur. In chronic severe Mitral regurgitation first heart sound (S1) is soft and a wide split in second heart sound (S2) is present. Low pitched third heart sound is heard sometimes, and fourth heart sound is audible in patients with acute severe Mitral regurgitation.

EFFECT OF HIGH BLOOD PRESSURE ON MITRAL VALVE AND ITS COMPONENTS

Mitral valve is a bicuspid leaflet located between the left atrium and the left ventricle. This apparatus allows unidirectional flow of blood from left atrium to left ventricle. Mitral valve has the largest surface area among other heart valves and is under highest pressure during the ventricular systole. This factor makes the mitral valve and its components prone to degeneration and dysfunction.

The components of mitral valve are mitral leaflets, chordae tendineae, commissures, annulus, papillary muscles and left ventricle. The two leaflets are anterior and posterior leaflets.^[8] Commissure is an area of leaflet that attaches at annular insertion. Annulus is the junction between left atrium and left ventricle to where mitral leaflets attach. When there is persistent long term untreated high blood pressure, workload of the left ventricle increases and the muscle tissues in the chamber thickens. This brings out left ventricular hypertrophy. This enlargement and thickening of heart walls can often lead to loss of elasticity of ventricular walls. The increasing filling pressure leads eventually to heart failure and irregular heart rhythms. This is usually asymptomatic but when progressed it clinically presents as chest pain after exertion, dyspnoea, fatigue and palpitations.

HIGH BLOOD PRESSURE AS RISK FACTOR FOR MITRAL REGURGITATION

Untreated elevated blood pressure for a long time increases pressure in the left ventricle which leads to structural changes on the mitral valve components and its function and can have an increased risk of mitral regurgitation.

Annulus is the area of mitral valve, which is most prone to the enlargement and changes with dilatation of the left heart.

Functional mitral regurgitation occurs as a result of dilatation of mitral valve annulus or papillary muscles with displacement of chordae tendineae.

According to the Framingham study, the high systolic blood pressure is seen directly proportional to mitral regurgitation.^[9] Hence long-term exposure to high blood pressure leads to risk of primary and secondary mitral regurgitation.

Hence high blood pressure can increase the risk of mitral regurgitation in a patient with no known pre-existing cardiac conditions.

MANAGEMENT METHODS FOR HIGH BLOOD PRESSURE

The main aim of hypertension management in the normal adult population is to bring down blood pressure to 140/90mmhg and less than 130/80mmhg in a comorbid person. Patients belonging to prehypertension and hypertension class require lifestyle modifications.^[5] The management measures of different hypertension classes are :

- Prehypertension: Lifestyle modification and no antihypertensive therapy is indicated.
- Stage 1: Thiazide like diuretics is most recommended, ACE inhibitors, Angiotensin II receptor blockers, calcium channel blockers or combinations are used.^[10]
- Stage 2: Two drug combinations used. Such as Thiazide diuretic and ACE inhibitors or beta blockers or calcium channel blockers. For patients with risk factors the other antihypertensives are also used.

PREVENTIVE MEASURES FOR HIGH BLOOD PRESSURE ARE^[11]

1. Control of normal BMI and low trans-fat intake
2. Controlled salt and saturated fat intake
3. Limiting high alcohol intake.
4. Proper sleep habits
5. Avoidance of smoking
6. Stress and anxiety reduction

CONCLUSION

High blood pressure affects the mitral valve and its components. This affects the preload and afterload of the heart. It's clear from Framingham study that high blood

pressure affects the mitral valve and can be a risk factor for development of mitral regurgitation in a patient with no known cardiac diseases. So, maintenance of blood pressure below the 120/80 mmHg level and early diagnosis and management of high blood pressure is necessary for avoiding many hypertensive complications.

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