

# THE COLLABORATION IN FIGHTING HYPERTENSION AND ITS COMPLICATIONS

## *Cardiologist's Perspective*

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### Introduction.

In 2008, cardiovascular disease (CVD) are responsible for over 17.3 million deaths per year (31% of the total of all annual deaths), and are the leading causes of death in the world. Deaths due to heart attacks, strokes and other types of CVDs as a proportion of total cardiovascular deaths for males and females are shown in Figures 1A and 1B, respectively.

In 2011 WHO reported in Global Atlas on Cardiovascular Disease Prevention and Control that hypertension is estimated to cause 7.5 million deaths worldwide (12.8% of the total of all annual deaths). This accounts for 57 million DALYS or 3.7% of total DALYS.

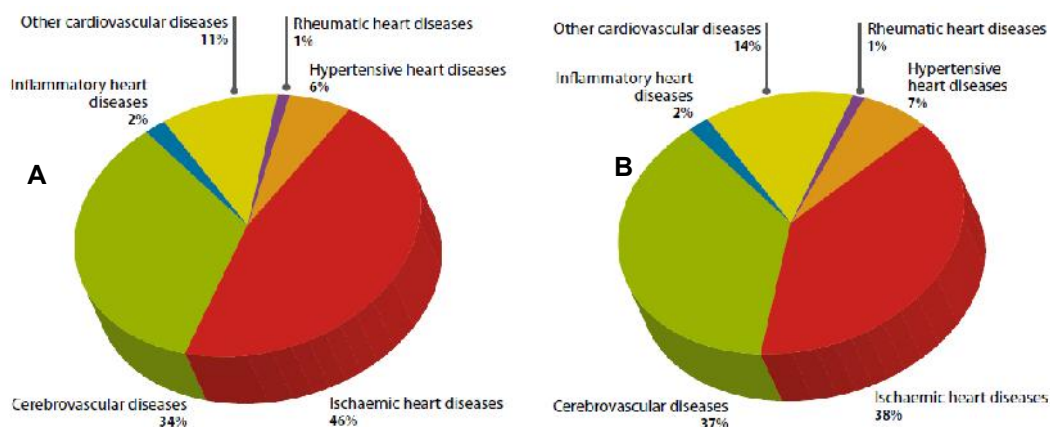


Figure 1. Distribution of cardiocerebrovascular disease deaths due to heart attacks, strokes and other types of cardiovascular diseases in males (A) and females (B) (Adopted from : Causes of death 2008, World Health Organization)

### Hypertension Complications

Hypertension places stress on several organs (called target organs), including the kidneys, eyes, brain and heart, causing them to deteriorate over time. High blood pressure contributes to 75% of all strokes and heart attacks.

Risk of complications or rapid progression of hypertension become more likely in the presence of other risk factors, including significant elevation of blood pressure, increasing age, smoking, abnormal cholesterol, family history of premature heart disease, obesity, diabetes, coronary artery disease, and other evidence of vascular disease. Hypertension must be monitored, treated and controlled by medication, lifestyle changes, or a combination of both.

### Heart Complications

High blood pressure is a major risk factor for hypertensive heart disease, the leading cause of illness and death from high blood pressure. Hypertensive heart disease is a group of complications that include:

- *Coronary Artery Disease (CAD)*. High blood pressure contributes to the thickening of the blood vessel walls, which can cause or worsen atherosclerosis. The end result is CAD, also called ischemic heart disease, which increases the risk for heart attack and death.

- **Heart Failure.** High blood pressure increases the heart's workload. Over time, this can cause the heart muscle to thicken. As the heart pumps against elevated pressure in the blood vessels, the left ventricle becomes enlarged and the amount of blood pumped by the heart each minute (cardiac output) goes down, a condition called left ventricular hypertrophy (LVH). Without treatment, this can lead to heart failure.
- **Cardiac Arrhythmias.** High blood pressure increases the risk for cardiac arrhythmias (atrial fibrillation, premature ventricular contractions, and ventricular tachycardia).

## Stroke

About two-thirds of people who suffer a first stroke have moderate elevated blood pressure ( $\geq 160/95$  mm Hg). Hypertensive people have up to 10 times the normal risk of stroke, depending on the severity of the blood pressure in the presence of other risk factors. Hypertension is also an important cause of so-called silent cerebral infarcts, or blockages, in the blood vessels in the brain (mini-strokes) that may predict major stroke or progress to dementia over time.

## Kidney Disease

Cardiorenal syndrome (CRS) defines a condition due to combined cardiac and renal dysfunction leading to the amplification of the progression of failure of the individual organs and a bad prognosis. Hypertension causes 30% of all cases of end-stage kidney disease, leads to more cases of kidney failure. Women with GFR 30-44 ml/min/1.73m<sup>2</sup> and men with GFR 30-50 ml/min/1.73m<sup>2</sup> but without history of CVD had a hazard ratio for CVD of 1.51 that increased to 2.39 in those with CVD history. Worsening of renal function is also an independent predictor of mortality in acute decompensated heart failure (ADHF). Between 27 and 45% of subjects admitted for acute heart failure suffered an acute worsening of renal function, with an increase in serum creatinine level (0.3 mg/dl) during hospitalization. The aging of the population, the amelioration of cardiac invasive procedures leading to a better prognosis of diseases that historically had a poor outcome have resulted in increasing number of patients with combined heart and kidney failure.

Hypertensive heart disease and HF with a normal ejection fraction are common among individuals with advanced and end-stage renal disease. One study showed that there is echocardiographic evidence of left ventricular hypertrophy (LVH) in 45% of individuals with creatinine clearance < 24 mL/min. Renal disease patients with LVH have accelerated rates of coronary events and markers of uremia compared with those with normal left ventricular mass, and a high proportion of these individuals develop clinical HF.

In patients with HF, renal dysfunction can result from intrinsic renal disease, hemodynamic abnormalities, or their combination. Cardiac pump failure leads to low cardiac output and hypotension, responsible of neurohormonal activation producing both fluid retention and vasoconstriction. However, the cardiorenal relationship is more complex than the hemodynamic model alone; activation of the renin-angiotensin system, nitric oxide, reactive oxygen species, inflammation, anemia and the sympathetic nervous system should also be taken into account.

In a recent study, found that patients with elevated intra abdominal pressure (IAP) had significantly lower baseline GFR compared with those with normal IAP, and the degree of reduction in IAP after diuresis predicted an improvement in renal function. Other initial hemodynamic parameters such as pulmonary capillary wedge pressure and cardiac index were not different between patients with elevated IAP and those with normal IAP. The concept that venous congestion, not arterial blood flow, is an important mediator of cardiorenal failure is supported by the findings of the Evaluation Study of Congestive Heart Failure and Pulmonary Artery Catheterization. The mechanisms underlying the relationship

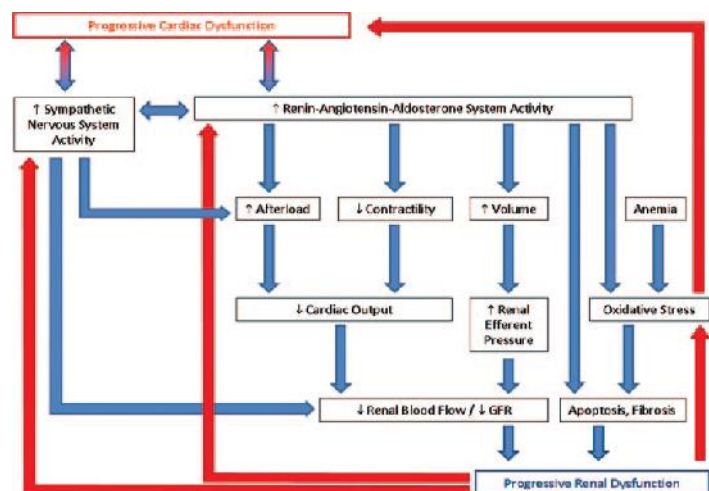


Figure 2. Postulated mechanisms underlying the relationship between heart failure (HF) and renal dysfunction. Blue arrows indicate pathways by which HF may lead to renal failure. Red arrows indicate pathways by which renal failure may lead to HF.

between heart failure (HF) and renal dysfunction is shown in Figure 2.

Cardiorenal syndrome patients were classified into 5 groups: type 1 was defined as acute cardiac decompensation leading to kidney injury, type 2 as congestive heart failure (CHF) leading to worsening renal function, type 3 as acute kidney injury leading to cardiac dysfunction, type 4 as chronic kidney disease (CKD) leading to CHF, and type 5 as systemic conditions leading to both cardiac and renal dysfunction.

### ***Diabetes***

High blood pressure, and some of the medications used to treat it, can increase the risk for developing diabetes. There are strong biologic links between insulin resistance (with or without diabetes) and hypertension. Up to 75% of cardiovascular problems in people with diabetes may be due to hypertension. The United States Preventive Services Task Force recommends screening for type 2 diabetes in all patients with blood pressure higher than 135/80 mm Hg.

People with diabetes or chronic kidney disease need to reduce their blood pressure to 130/80 mm Hg or lower to protect the heart and help prevent other complications common to both diseases.

### ***Eye Damage***

High blood pressure can injure the blood vessels in the eye's retina, causing a condition called retinopathy.

### ***Sexual Dysfunction***

Sexual dysfunction is more common and more severe in men with hypertension and in smokers than it is in the general population.

## **Summary**

Hypertension, widespread atherosclerotic vascular damage and diabetes are significant risk factors for stroke, heart attack, heart failure and renal failure. Heart failure leads to low cardiac output and hypotension, responsible of neurohormonal activation (renin-angiotensin system, nitric oxide, reactive oxygen species, inflammation, anemia and the sympathetic nervous system) - producing fluid retention, venous congestion and vasoconstriction - important mediators of cardiorenal syndrome. Collaboration of multidisciplinary experts especially Cardiologist, Neurologist, Nephrologist and Diabetologist is important in prevention and control of stroke, heart attack, heart failure and renal failure because they share common risk factors and pathophysiology.

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