

## Relationship between Hypertension and Renal Disease

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### Abstract.

The papers are an overview of the importance of hypertension with the incidence of chronic kidney failure, which is a product of 158 papers discovered through various search engines such as PubMed, Google Scholar and Ebsco Cinahl. Specific standards have been developed to ensure that coincidental and high quality of the selected articles are used as a guide in this paper. There is some information that aims to provide updates to medical practitioners on the relevance of hypertension with kidney disease where information presented is the latest information and suitable for use as a reference. In the mean time, this review also aim to provide updates to medical practitioners on the relevance of hypertension with kidney disease where information presented is the latest information and is suitable for use as a current reference. In this review, some of the findings that have been found are mainly related to risk factors that lead to the renal failures such as benign nephrosclerosis, obesity, glucose intolerance, high serum acid levels, albuminuria, and genetic factors. In addition, high blood pressure levels are also characterized by malignant nephrosclerosis, characterized by impaired intrarenal microvascular and glomerular structures, damage to kidney function, proteinuria and hematuria develop.

Keywords: Chronic kidney failure, Nephrosclerosis, Albuminuria, Microvascular, Proteinuria and Hematuria

### Introduction

Hypertension and chronic renal disease are a major concern of public health and the incidence and prevalence rate is rising every year. It not only impacts patient wellbeing but also impacts mortality, morbidity and puts a major economic strain on the health care system in particular (Evans & Taal, 2015; Jager & Fraser, 2017).

Hypertension can be characterised as a persistent 140mmHg or higher systolic blood pressure (BP) elevation and or 90mmHg or higher diastolic BP. Taken on two separate occasions minimum twice. However, according to the World Health Organization (2019), hypertension is a condition that reaches 130mmHg or more than 80mmHg. If there is a disparity between the interpretations of hypertension, it should not change the way patients are treated. Humphreys *et. al*, 2017, MOH, 2018).

Damage to the target organ is a complication of hypertension disease. Due to hypertension, there are 2 types of target organ injury. Micro vascular injury is first. It caused damage to the small blood vessels and resulted in micro vascular injury. An example retinopathy, nephropathy, neuropathy, and so on. Secondly, macro vascular injury, causing damage to the large blood vessels that began with microvascular injury and then progressed to macro vascular injury. Coronary artery disease, myocardial infarction, congestive heart failure, and renal failure are examples of macro vascular injury (Sunar, 2011; Tadesse *et. al*, 2017)

Meanwhile, chronic renal disease, identified as persistent renal injury, reflected either by reduced glomerular filtration rates (estimated GFR less than 60ml / min/1.73m<sup>2</sup>) or by increased urinary excretion of albumin (Zhang and Rothenbacher, 2008; Dan, *et.al*, 2019). CKD prevalence ranges from 8-16% of the adult population. While extreme renal damage is associated with increased risk of end-stage renal disease (ESRD), the marker of cardiovascular disease (CVD) is a milder degree of renal damage (Zhang, Rothenbacher, 2008; Agarwal, 2011).

### **Etiology of the Hypertension Disorder**

The cause and effects of CKD are hypertension. In comparison, there was no risk of non-malignant critical (primary) hypertension causing End Stage Renal Disease in a few studies (Hsu, 2002, Berbari & Daouk, 2017). There was some research among patients with hypertension showing no important result between incidence rate and ESRF prevalence among patients with essential hypertension. Analysis by Segura *et. al*, (2004), there was a non-significant change in the rate of glomerular filtration by 0.92ml / min per year for patients with hypertension. GFR indicated 0.75 ml / min per annum as opposed to normotensive patient. It differential just 0.17ml / min per year. Progressive hyalinization and sclerosis of pre-glomerular renal vascular, frequently reported in patients with non-malignant hypertension known as hypertensive nephrosclerosis, has been postulated and there is insufficient evidence to indicate that long-term high blood pressure exposure may not be potentially significant to trigger ESRF (Bidani *et al*, 2013). But In 2013, Study conducted by Vaclac (2013), indicated hypertension of any aetiology may result in renal disease whether benign or malignant nephrosclerosis is present. On the other hand, uncontrolled blood pressure can also lead to renal disease in the case of essential hypertension.

Nephrosclerosis of hypertension is a nephropathy-associated disease affecting two Variants, known as benign (nonmalignant) and malignant nephrosclerosis.

### **Benign hypertension**

Benign hypertension is a long-lasting, mildly to moderate severity; it does not imply aetiology, although it is most commonly seen as essential hypertension. Benign nephrosclerosis has been widely associated with long-standing benign hypertension and asymptomatic renal changes (Chanda and Fenves 2009; Agarwal, 2011). Renal biopsy can be used to diagnose benign hypertensive Nephrosclerosis. But since it has rarely been done, assessment by external evaluation such as complete disease history is an indication of long-standing hypertension, physical examination and laboratory testing findings such as non-nephrotic proteinuria without any other renal disease. Long-standing hypertension may lead to loss of renal self-regulation and

exposure to intra-renal vasculature for renal biopsy or histopathology (American Urology Association, 2020),

### **Malignant Hypertension**

Malignant hypertension can be occurs in 1-5% of hypertension patients and also can be develop by healthy people but unlikely more often people underlying of benign hypertension or renal disease(Naranjo and Paul, 2020). Basically vascular in renal damage can lead to fibrinoid necrosis formation in small vesselsand lead to hyperplastic arteriolosclerosis, renal ischemia, renin-angiotensin system stimulated can cause increasing level of renin. Meanwhile, etiology of malignant hypertension are variable, but if malignant hypertension are not well treat it can be severe and also can develop Full blown syndrome characterized by diastolic hypertension more than 130 mmHg, with or papilledema retinopathy, encephalopathy, cardiovascular abnormality, and renal failure in certain time it also can cause hypertensive crises such as loss of consciousness or convulsion (American Urological Association, 2020).

American Urological Association, (2020). based on examination finding, malignant hypertension can be identify by duration and severity of hypertensive disease, small petechial hemorrhages on the cortical surface give a "flea-bitten" appearance to the renals

From histology examination, Interlobular arteries and arterioles demonstrate densely eosinophilic material representing fibroid necrosis of the vessel walls, meanwhile, blood vessel in Intima wall was thickening. For blood vessels appearance it show hyperplastic arteriolitis and lastly micro thrombi can be present. However, prognosis of malignant hypertension are not very good. With anti-hypertensive drugs, 75% of patients survive in 5 years; fatal without treatment with 90% mortality within a year(American Urological Association, 2020).

### **Level of Blood Pressure**

There are 2 study conduct to identify the relationship between level of blood pressure and progression of renal failure. Once study known Multiple Risk Factor intervention Trial (MRFIT) and Kaiser Permanente of Northern California (Klag, *et. al.* 1996; & Hsu, *et. al.*,2005). Summary of both study stated that,the incidence of nephropathy in hypertensive subjects with no evidence of primary renal disease was low as 15.6 and 14.3 cases per 100,000 persons-years respectively. Meanwhile, the risk of ESRD was associated with increasing BP levels throughout the BP readings above the optimal level. It show that, if higher the BP levels the higher the risk of renal failure. In other hand systolic blood pressure level can be used as stronger predictor of CKD with 1 standard deviation (SD) are doubling the CKD risk

According to Meyrier (2015)&American Renal Fund (2020), Other risk factors have been reported to increase the susceptibility to renal failure in benign nephrosclerosis, including race, obesity, glucose intolerance, high serum uric acid levels, albuminuria, and genetic factors.

Development of proteinuria, renal function impairment disruption of the intra renal microvascular glomerular structure can be cause by malignant hypertension induce by malignant nephrosclerosis lead by persistent high blood pressure or long-standing of hypertension (Sharma, *et al.*, 2014).

## Prevalence of Chronic Renal Diseases

Estimation of prevalence there are 60% of Hypertension patient with CKD may reach about 95% in stage 3 to stage 5 CKD (Barbari & Daouk, 2017). But it also depend on extrinsic factor such as type of nephropathy and percentage of renal functional impairment.

Barbari and Daouk (2017) stated there are higher percentage of CKD are by renal vascular disease induce by hypertension showed 93% meanwhile, second are 87% are diabetic nephropathy and third places are 74% in polycystic renal disease. There are increasing number of incidence of CKD and hypertension. They are inverse relationship between prevalence of hypertension and renal functional impairment. Meanwhile, Ames (2018) and Leung, *et al.*, (2017) estimated that there are 92% hypertension patient has glomerular filtration rate (eGFR) less than 30 ml/min/1.73m<sup>2</sup>. Meanwhile, 67% patient with had elevated blood pressure was develop glomerular filtration rate (eGFR) more than 60ml/min/1.73m<sup>2</sup>

## Risk Factors for Chronic Renal Disease

Non communicable disease known as major contribution for chronic renal disease. Two major disease that contribute to CKD are Diabetes and Hypertension. The highest prevalence was renal vascular disease with percentage of 93% followed by diabetes nephropathy with percentage of 87% (Tanamas *et al.*, 2012; Jha *et al.*, 2013; Levin *et al.*, 2017; Qaseem *et al.*, 2013;). Conferring to ratio, one in every three adult with diabetes and one in five adults with hypertension can develop CKD In Malaysia, one in every five adults have diabetes and total of 3.9 million Malaysian have diabetes. For Hypertension 3 in 10 adult are having hypertension. It take around 6.4million people in Malaysia have hypertension (Malaysia Ministry of Health, 2019; Centres for Disease Control and Prevention, 2014). People with hypertension are five times prone to develop CKD compare to without. Lifestyle also contribute to increase risk of CKD (Cui, *et al.*; 2011 and Tanamas *et.al.* 2012)

Other factor that can contribute to chronic renal disease are smoking. Based on Tomson & Bailey, (2011); Yacoub *et al.* (2010) smoking can increases the risk of CKD. For those patient who underlying Diabetes and hypertension, plus with smoking have high risk to develop CKD compare people without smoking (McClellan & Plantiga, 2012, KDIGO 2013)

Other risk factor that related to chronic renal disease are obesity. Obesity are always related to other non-communicable disease. The world prevalence of obesity has been accompanied by an increase in the incidence of diseases, such as diabetes, hypertension, cardiovascular disease, and CKD. Weight reduction in people can reduce the risk of CKD (Flesher *et al.*, 2011; Lowth, 2013, Eckardt *et al.*, 2013).

Over excretion of albuminuria also can increase risk to develop CKD, ( Márquez, *et al.*, 2019). Men Urine albumin/creatinine ratio greater than 6.67 mg/g and greater. Meanwhile for women than Urine albumin/creatinine ratio greater than 15.27 mg/g in women. was related with doubling the risk of developing hypertension (Inker, *et al.*, 2011; Barbari & Daouk, 2017).

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