The message for World Kidney Day 2009: hypertension and kidney disease—a marriage that should be prevented

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Introduction

The kidney is both a cause and victim of hypertension. High blood pressure is a key pathogenetic factor that contributes to deterioration of kidney function. Presence of kidney disease is a common and under-appreciated pre-existing medical cause of resistant hypertension [1]. Therefore, treatment of hypertension has become the most important intervention in the management of all forms of chronic kidney disease (CKD). For this reason, the forthcoming World Kidney Day (WKD) on 12 March 2009 will emphasize the role of hypertension in renal disease.

How does one recognize the presence of chronic kidney disease?

In contrast to a decade ago, today, most laboratories around the world report estimated glomerular filtration rate (eGFR) instead of or in addition to serum creatinine level. This now

provides the physician with information about kidney function that is, in general, more informative. As a result, a greater percentage of patients with diabetes or hypertension and their physicians have a better knowledge of their kidney function. Assessment of eGFR as an index of kidney function should be complemented by the assessment of urine for protein or albumin (preferred).

In spite of these laboratory updates, recent data demonstrate that a given patient's knowledge that he or she has CKD is very low. In a recent analysis of almost half a million people in Taiwan who took part in a standard medical screening program, 12% had CKD [2]. It was noteworthy that fewer than 4% of those with CKD were aware of their condition. People with CKD are several times more likely to die from cardiovascular (CV) causes than those without CKD; thus, hypertension is a major risk factor in this context [3]. The combination of CKD and hypertension, therefore, is a major public health issue; because of the costly treatments necessary for end-stage renal disease (ESRD), end-stage CKD has also become a substantial burden to health budgets.

What is the worldwide frequency of chronic kidney disease?

The frequency of CKD continues to increase worldwide, as does the prevalence of ESRD [4, 5]. The most common, but not only, causes of CKD are hypertension and diabetes. The presence of CKD is associated with a large increase in CV risk. Moreover, CV risk increases proportionally as eGFR falls below 60 ml/min. Lastly, death from CV causes is higher in CKD and much higher than is cancer in CKD; as a result, the identification and reduction of CKD has become a public health priority [6].

On behalf of the **World Kidney Day 2009 Steering Committee**:
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Between 1999 and 2006 in the most recent national health and nutrition examination survey (NHANES), representing United States residents aged 20 years and older, 3.4 million out of ~26 million adult participants had CKD stages 1–4; of these, 65.3% had CKD stage 3 or 4. Those with diabetes and hypertension had far greater prevalences of CKD (37% and 26%, respectively) than did those without these conditions (11% and 8%, respectively) [7].

The most recent report of the United States Renal Data System estimates that nearly one-half million patients in the United States of America were treated for ESRD in 2004 [8], and by 2010 this figure is expected to increase by approximately 40%. Patients destined to progress to ESRD, i.e. the elderly, are a growing segment of the population. Additionally, male individuals and African-Americans with pre-existing hypertension and CKD are also at much higher risk for ESRD [9]. This observation has also been confirmed throughout the developed world: Europe, Asia, Australia and regions of India and Africa [4, 5].

The role of hypertension

Hypertension is a global problem, and the situation is projected to become worse. It is the major risk factor for development and progression in nondiabetic and diabetic CKD.

The world population is getting older, and aging is the most common risk factor for the development of hypertension and diabetes as well as CKD. Nearly one billion people worldwide have high blood pressure (defined as $> 140/90$ mmHg), and that number is expected to increase to 1.56 billion people by 2025 [10]. The prevalence of hypertension is predicted to increase by 24% in developed countries and by 80% in developing regions such as Africa and Latin America. One report noted that 333 million adults in economically developed regions such as North America and Europe had high blood pressure in 2000, and an additional 639 million people in developing countries have this condition.

In 1999–2006 the prevalence of hypertension in US adults was 43.4% when defined as $>140/90$ mmHg, and similar values have been reported from many Western countries [9]. The rates of hypertension were highest in participants who were 60 years or older, i.e. 68–80% versus 25% in those between 20 years and 39 years old, in non-Hispanic blacks (53%) versus Caucasians (43%) versus Mexican-Americans (34%). Furthermore, hypertension was more common in individuals with a higher body mass index (BMI) (60% for BMI ≥ 35 vs 32% for BMI of 23). Slightly more than half of adults with hypertension were aware of their disease in 1999–2004; fewer than half were treated for

their hypertension with medications; and the condition in fewer than two-thirds was controlled to $<140/90$ mmHg with medication [9]. This trend in poor blood pressure control is observed worldwide.

The hypertension control rate is substantially less in patients with CKD, particularly those with diabetes and CKD [1, 9]. This is illustrated by the National Kidney Foundation's (USA) Kidney Early Evaluation Program (KEEP), a US-based health-screening program for individuals at high risk for kidney disease [9]. The prevalence (86.2%), awareness (80.2%), and treatment (70.0%) of hypertension in the screened cohort were high, however, blood pressure control rates were low (13.2%). The proportion of hypertensive patients increased with advancing stages of CKD.

Which blood pressure component is most relevant for renal and cardiovascular risk, systolic or diastolic?

There is now consensus, based on the totality of the data, that systolic rather than diastolic blood pressure poses the greater risk for cardiovascular events and kidney disease progression. Against this background, it is relevant that, in the KEEP study, elevated systolic blood pressure accounted for the majority of patients with inadequate control. Male gender, non-Hispanic black race, and BMI of 30 kg/m² or more were inversely related to blood pressure control.

What is the blood pressure target for CKD patients? According to the different guidelines published by the major kidney societies, systolic blood pressure should be lowered to values <130 mmHg or 125 mmHg if greater than 1 gram/day of proteinuria is present. One has to be aware, however, that as a predictor of adverse CKD or cardiovascular events, office blood pressure may be inferior compared to ambulatory blood pressure measurement [11]. This issue is particularly relevant in CKD because of the tendency for nighttime blood pressure to be elevated (little or no nocturnal dip in blood pressure) and the fact that central (aortic) blood pressure tends to be higher than peripheral (brachial) blood pressure [11, 12]. In patients with diabetes, guidelines all recommend that lower blood pressure targets may provide further benefit, but prospective trials have, thus far, failed to confirm this epidemiological observation.

The role of diabetic nephropathy

As indicated above, diabetes and hypertension are the most common causes of CKD. There are currently over 240 million people with diabetes worldwide. This number is

projected to rise to 380 million by 2025, largely due to population growth, aging, urbanization, unhealthy eating habits, increased body fat and a sedentary lifestyle. By 2025, the number of people with diabetes is expected to more than double in south-east Asia, the eastern Mediterranean and Middle East, and Africa. It is projected to rise by nearly 20% in Europe, 50% in North America, 85% in South and Central America and 75% in the Western Pacific region. The top five countries with the highest prevalence of diabetes in order include India, China, the USA, Russia and Japan. Worldwide, more than 50% of people with diabetes are unaware of their condition and are not being treated.

The same behaviors that increase obesity are shared with those predisposed to diabetes, i.e. family history, presence of hypertension, ageing, excess body weight, lack of exercise and unhealthy dietary habits. It is important that these risks be identified early, so that the development of diabetes and CKD may be reduced, since CKD greatly amplifies the risk of cardiovascular events in the diabetic patient.

The remaining challenge

Under-diagnosis and under-treatment of CKD is a worldwide problem: not only is CKD awareness low worldwide, but also the relative lack of awareness of CKD risk factors by physicians, i.e. hypertension and diabetes, is even more disturbing. Moreover, even awareness of these risk factors does not ensure adequate treatment; this could relate either to the behavior of the patient, the provider, or both. Thus, the problem of CKD remains a challenge, as exemplified by recent data showing that between 1999 and 2006, <5% of people with an eGFR <60 ml/min per 1.73 m² body surface area and proteinuria were aware of having CKD; of those with CKD stage 3, awareness was only 7.5%; for stage 4, awareness was less than 50%. Awareness rates among those with CKD stages 3 or 4 were higher if co-morbid diagnoses of diabetes and hypertension were present, but, even then, they were quite low (20% and 12%, respectively).

One barrier we have to overcome in order to ensure greater awareness is a more focused education of physicians, since they are the purveyors of the diagnoses of patients' medical conditions. In one survey more than one-third of primary care physicians in the USA were not aware that family history was a risk factor for CKD, while almost one-quarter did not perceive African-American ethnicity as a CKD risk factor; in contrast, nearly all perceived diabetes (95%) and hypertension (97%) as risk factors for CKD. Even more problematic was the fact that, while diabetes and hypertension were acknowledged as

CKD risk factors, the control rates achieved (defined as reaching guideline goals) sadly remains well below 50% among those treated.

What can be done about this problem?

There have been many consensus panels over the past decade to approach ways to achieve better blood pressure control and educate physicians about the stages of CKD [13, 14]. The road to improved outcomes is to focus on public awareness and screening programs, as well as programs to educate both patients and physicians. Data from the KEEP screening program in the USA has also noted that blood pressure values are most likely to be at goal once patients are aware they have kidney disease [15]. Data from Bolivia highlights the observation that once kidney disease is diagnosed, more appropriate interventions to reduce CKD risk factors such as hypertension are instituted [13].

Programs to address these issues have started around the world, including KEEP-type programs. As a major focus of World Kidney Day this year the issue is hypertension in CKD (<http://www.worldkidneyday.org>).

Because of the aging world population and consequent increasing prevalence of hypertension and diabetes, CKD rates will continue to increase. This has, and will, continue to place an undue economic burden on societies, given the costs for an ESRD program. In 2005, the USA spent \$32 billion dollars on such programs. These facts mandate that measures be put forth to ensure timely detection and prevention of CKD progression. The key to ensure successful prevention of CKD is screening for hypertension, improved testing and diagnosis of predisposing co-morbidities, such as diabetes, and aggressive treatment to guideline goals.

The International Society of Nephrology (ISN) and the International Federation of Kidney Foundations (IFKF) have an ambitious long-term goal, worldwide, that every individual, particularly the patient with diabetes, knows his or her blood pressure values. Additionally, they should be aware that prompt treatment is necessary once blood pressure values are no longer in the normal range. Finally, our societies strongly encourage public health authorities to support efforts to raise public awareness of CKD and promote moves to reduce the risk of developing hypertension. Such governmental public health initiatives are exemplified by countries like the United Kingdom, Finland and Japan, who have reduced salt in the diet and mandate that labels show sodium content, as in the USA. These initiatives have proven highly successful, based on reduction in cardiovascular mortality and morbidity rates.

References

1. Sarafidis PA, Bakris GL (2008) State of hypertension management in the United States: confluence of risk factors and the prevalence of resistant hypertension. *J Clin Hypertens (Greenwich)* 10:130–139
2. Wen CP, Cheng TY, Tsai MK, Chang YC, Chan HT, Tsai SP, Chiang PH, Hsu CC, Sung PK, Hsu YH, Wen SF (2008) All-cause mortality attributable to chronic kidney disease: a prospective cohort study based on 462 293 adults in Taiwan. *Lancet* 371:2173–2182
3. McCullough PA, Jurkowitz CT, Pergola PE, McGill JB, Brown WW, Collins AJ, Chen SC, Li S, Singh A, Norris KC, Klag MJ, Bakris GL, for the KEEP Investigators (2007) Independent components of chronic kidney disease as a cardiovascular risk state: results from the Kidney Early Evaluation Program (KEEP). *Arch Intern Med* 167:1122–1129
4. Atkins RC (2005) The epidemiology of chronic kidney disease. *Kidney Int* 67: S14–S18
5. Alebiosu CO, Ayodele OE (2005) The global burden of chronic kidney disease and the way forward. *Ethn Dis* 15:418–423
6. Rosamond W, Flegal K, Furie K, Go A, Greenlund K, Haase N, Hailpern SM, Ho M, Howard V, Kissela B, Kittner S, Lloyd-Jones D, McDermott M, Meigs J, Moy C, Nichol G, O'Donnell C, Roger V, Sorlie P, Steinberger J, Thom T, Wilson M, Hong Y, American Heart Association Statistics Committee and Stroke Statistics Subcommittee (2008) Heart disease and stroke statistics—2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation* 117:25–146
7. Ostchega Y, Yoon SS, Hughes J, Louis T (2008) Hypertension awareness, treatment, and control—continued disparities in adults: United States, 2005–2006. NCHS Data Brief. Available at <http://www.cdc.gov/nchs/data/databriefs/db03.pdf>
8. Coresh J, Selvin E, Stevens LA, Manzi J, Kusek JW, Eggers P, Van Lente F, Levey AS (2007) Prevalence of chronic kidney disease in the United States. *JAMA* 298:2038–2047
9. Sarafidis PA, Li S, Chen SC, Collins AJ, Brown WW, Klag MJ, Bakris GL (2008) Hypertension awareness, treatment, and control in chronic kidney disease. *Am J Med* 121:332–340
10. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J (2005) Global burden of hypertension: analysis of worldwide data. *Lancet* 365:217–223
11. Peterson GE, de Backer T, Gabriel A, Illic V, Vagaonescu T, Appel LJ, Contreras G, Kendrick C, Rostand S, Phillips RA, African American Study of Kidney Disease Investigators (2007) Prevalence and correlates of left ventricular hypertrophy in the African American Study of Kidney Disease Cohort Study. *Hypertension* 50:1033–1039
12. Townsend RR (2007) Analyzing the radial pulse waveform: narrowing the gap between blood pressure and outcomes. *Curr Opin Nephrol Hypertens* 16:261–266
13. Perico N, Plata R, Anabaya A, Codreanu I, Schieppati A, Ruggenenti P, Remuzzi G (2005) Strategies for national health care systems in emerging countries: the case of screening and prevention of renal disease progression in Bolivia. *Kidney Int* 68: S87–S94
14. Whelton PK, Beevers DG, Sonkodi S (2004) Strategies for improvement of awareness, treatment and control of hypertension: results of a panel discussion. *J Hum Hypertens* 18:563–565
15. Rao MV, Qiu Y, Wang C, Bakris G (2008) Hypertension and CKD: Kidney Early Evaluation Program (KEEP) and National Health and Nutrition Examination Survey (NHANES), 1999–2004. *Am J Kidney Dis* 51:S30–S37