Hypertension and Chronic Kidney Disease in China

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The global rise in the number of patients with chronic kidney disease (CKD) and consequent end-stage renal disease (ESRD) requiring costly renal replacement therapy is putting a substantial burden on worldwide health care resources. Hypertension could be both an initial and progressive factor in CKD. Furthermore, it is a major risk factor for cardiovascular disease, stroke and other comorbidities in CKD patients. Given this background, further investigation of hypertension in CKD patients could be beneficial in improving both renal and cardiovascular outcomes.

China is now the world's largest developing country with a large population of CKD patients. According to the China National Nutrition and Health Survey 2002, one in six Chinese adults is hypertensive and few have their hypertension effectively under control [1]. Moreover, the prevalence of hypertension increases significantly thereafter--according to recently published data from the World Health Organization, the estimated prevalence of raised blood pressure in China reached 38.2% in 2008 [2]. The changing epidemiology of hypertension nowadays shows that the number of hypertensive subjects has increased rapidly during the past decade, and the situation is even more serious in CKD patients. These data therefore underscore the necessity of further studies focusing on hypertension and CKD in Chinese patients. In our previous newsletter, we introduced recent hotspots for CKD research as well as epidemiological data on CKD in China [3] and received much positive feedback. To further strengthen the collaboration between Chinese nephrologists and colleagues elsewhere and share our own experiences, we dedicate this issue of the newsletter to studies on hypertension in CKD in China.

In a nationwide survey on CKD prevalence in the general population [4], hypertension is among several independent risk factors associated with kidney damage. The study showed that 32.9% (13 533/41 165) of the participants without kidney damage had hypertension. However, the prevalence of hypertension was almost doubled in the participants with kidney damage--60.5% for participants with an eGFR <60ml/min and 61.2% for participants with albuminuria. Further analysis demonstrated that the prevalence of hypertension was higher in urban areas than in rural areas, which might be due to the different socioeconomic status and the accompanying changes in lifestyle. Unlike prevalence, the control of hypertension in CKD patients was much better in the urban areas. Although a recent survey on hypertension and CKD, which recruited 190 000 hypertensive patients from the second largest district in Shanghai, showed a management rate of hypertension of >90%, much work still needs to be done as the impact of economic development and GDP should not be neglected. One obvious fact is that economically developed urban areas usually have better health care, and residents have a better educational background which shows the better management of hypertension and CKD in those regions.

In our community studies performed in Shanghai [5], 16% of all participants were found to have newly detected raised blood pressure in addition to the 34.2% of participants who were diagnosed with hypertension before the survey. Half of these subjects (49.4%) were taking antihypertensive medication. Similar to the nationwide survey [4], hypertension was also one of the risk factors for CKD in our study with an OR value of 1.46 [5].

In another epidemiological study performed in Mainland China, the Prevalence, Awareness, and Treatment Rates in Chronic Kidney Disease Patients with Hypertension in China (PATRIOTIC) Collaborative Group [6] reported that the prevalence of hypertension in non-dialysis CKD patients was 67.3%. The awareness and treatment of hypertension in participants were 85.8 and 81.0%, respectively. Further statistical analysis showed that the control of hypertension decreased while CKD stages advanced. In Chinese ESRD patients, Reynolds and colleagues [7] showed that systolic blood pressure was a stronger predictor of ESRD than diastolic BP or pulse pressure. There was a strong, independent and graded association between BP and risk for ESRD in the Chinese population.

In the CKD SD patients, cardiovascular and cerebrovascular diseases (CVD) are the leading cause of death in these patients, which account for nearly 40% of all deaths [8]. Similar to the studies in patients with CKD SD, inflammation and hypertension were important risk factors of CVD in hemodialysis patients. Likewise, a high prevalence of hypertension was found in peritoneal dialysis (PD) patients, but to determine the correlation between blood pressure and all-cause or cardiovascular death in PD patients requires further studies.

Apart from epidemiological studies, other investigations have been carried out and quite a few fascinating findings have been discovered. In the genetic study of hypertensive patients, genome-wide association studies (GWAS) were performed and several new genetic variants were discovered and reported. As hypertension was closely associated with vascular damage, a new term--ambulatory arterial stiffness index (AASI)--was proposed and its clinical significance was evaluated. Furthermore, the mechanism of vascular remodeling in hypertension, maladaptive activation of the renin-angiotensin system (RAS) in hypertension and CKD and the role of endothelin and aldosterone on blood pressure regulation were carefully investigated and provided us with new insights into hypertensive organ damage. The results from these interesting studies are also presented in detail in the following section of this issue of this newsletter which shows the contribution of hypertension to CKD in China.
To sum up, hypertension, which is one of the major non-communicable diseases, has a high prevalence in Chinese CKD patients. The discrepancy between high prevalence and low control rate among different areas stresses the need to develop national strategies for hypertension management in CKD in China. One logical step might be to promote the integration between home, clinic and office blood pressure monitoring. Furthermore, hypertension is one of the most common but also preventable and reversible risk factors for CKD in China. Uncontrolled blood pressure can exacerbate kidney damage and CKD progression. Since CKD has become an important public health problem and the prevalence of hypertension in China is increasing rapidly, the Chinese government is paying special attention to this problem and is well aware that further investigation must be carried out to improve the prognosis and reduce mortality.


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The Shanghai Institute of Hypertension was established in 1958 under the auspices of the municipal government of Shanghai. The institute is dedicated to clinical, basic, population and translational research in hypertension. Within the institute, there are several research platforms, such as the Shanghai Key Laboratory of Hypertension, Cellular and Molecular Biology Laboratory, Center for Epidemiological Studies and Clinical Trials, Center for Vascular Evaluations and Center for Community Control of Hypertension. The clinical wing of the institution is the Department of Hypertension in Ruijin Hospital. This institute offers postgraduate programs for masters and doctoral degrees in cardiovascular medicine in the Shanghai Jiao Tong University School of Medicine.

Over the years, and especially in the past decade, the institute has published a series of scientific reports in the international literature. Hypertension is an apparent multifactorial polygenic disease. In the genomic and post-genomic era of biological research, we built a biological bank of more than 10,000 hypertensive patients and normotensive controls for genetic and genomic studies on hypertension, and performed genome-wide association studies in the Chinese population. Using the early technique of microsatellite markers, a susceptibility locus for hypertension was mapped to the chromosome region 2q14-q23 (Zhu DL, et al. J Hypertens 2001;19:55-61). In subsequent association and functional studies, a rare variant, Arg188Gln, of the kynureninase gene (KYNU) located in this region was found to be associated with hypertension, and the KYNU protein with the mutation (Gln) showed less catalytic efficiency than the wild-type enzyme (Zhang Y, et al. Circ Cardiovasc Genet. 2011;4:687-94). We also performed a genome-wide association study on the basis of SNPs, and participated in the pan-Asia collaboration of genome-wide association studies. This collaborative project confirmed seven loci that had been previously reported to be associated with systolic and/or diastolic blood pressure in populations of European descent. In addition, this project identified several new genetic variants (ST7L-CAPZA1, FIGN-GRB14, ENPEP, NPR3 and TBX3) associated with hypertension (Nat Genet 2011, 43, 531-538.).

In our population studies, we defined an arterial stiffness index on the basis of ambulatory blood pressure
showed that 53.1% of all participants had hypertension. Hypertension ranked as the second leading cause of
epidemiology study based on 5207 CKD patients from 15 renal centers in Shanghai. Our data
Survey in Multiple Renal Centers in Shanghai
been suggested that health education and
hypertension is high and the awareness and treatment rate relatively low among residents of Shanghai.
respectively. Preliminary analysis of data from our epidemiology study shows that the prevalence of
hypertension and 49.4% of them were receiving antihypertensive treatment. In addition, of all the
diagnosed with hypertension before the survey. Of all hypertensive subjects, only 68.7% noted that they had
found to have newly detected raised blood pressure in addition to 2069 (34.2%) participants who were
enrolled into this study. The mean age was 52.4 ± 17.5 years. Among all of the participants, 942 (16%) were
randomly recruited from random blocks in two districts in Shanghai. Requirements for recruitment into the
communities in Shanghai. In our three-tier cluster community studies, a reasonable number of residents were
A population-based survey was conducted during the past five years with a random cluster sampling in
research in this field focuses on the incidence, awareness and control of hypertension in different populations
based on data from community studies, surveys from multiple renal centers and hospital-wide epidemiology
investigations. We also investigated blood pressure variance (BPV) and its impact on clinical outcomes in
hypertension, and on vascular adventitia. Early previous studies suggested that adventitia may play an important
role in the formation of vascular lesions in hypertension.

Hypertension affects approximately a quarter of the adult population. Hypertension control therefore requires
joint efforts of the community, including patients themselves and their community as well as family physicians.
The institute recently started a collaborative project in a community in Shanghai to do research on the
management of hypertension. We established a web- and wireless-based system for the measurement,
transmission, storage and analysis of blood pressure. This automated system might improve blood pressure
management of hypertension. We established a web- and wireless-based system for the measurement,
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control in this community, and, in the future, will hopefully expand to the whole city of Shanghai or even other
Chinese provinces, and in the longterm help reduce the risk of cardiovascular complications of hypertension.

Hypertension is one of the most common causes of ESRD in China. In addition, there is abundant evidence that
hypertension is an independent promoter of kidney damage. As one of the earliest established and best
equipped renal centers in China, the Department of Nephrology of Shanghai Ruijin Hospital has been dedicated to
the clinical and basic studies of hypertension and chronic kidney diseases during the past decades. Our
research in this field focuses on the incidence, awareness and control of hypertension in different populations
based on data from community studies, surveys from multiple renal centers and hospital-wide epidemiology
investigations. We also investigated blood pressure variance (BPV) and its impact on clinical outcomes in
patients with different CKD stages.

Community Studies
A population-based survey was conducted during the past five years with a random cluster sampling in
communities in Shanghai. In our three-tier cluster community studies, a reasonable number of residents were
randomly recruited from random blocks in two districts in Shanghai. Requirements for recruitment into the
study were age of at least 18 years and 6 months of residency. Hypertension was defined as a mean SBP ≥140
mmHg and/or DBP ≥90 mmHg and/or current use of antihypertensive medications. Demographic, laboratory
data and physical examinations including blood pressure were recorded. A total of 6053 residents were
enrolled into this study. The mean age was 52.4 ± 17.5 years. Among all of the participants, 942 (16%) were
found to have newly detected raised blood pressure in addition to 2069 (34.2%) participants who were
diagnosed with hypertension before the survey. Of all hypertensive subjects, only 68.7% noted that they had
hypertension and 49.4% of them were receiving antihypertensive treatment. In addition, of all the
hypertensive subjects, 11.1% had albuminuria and 6.1% of them also had decreased kidney function. Based
on the CKD definition of the Kidney Disease Outcomes Quality Initiative (K/DOQI) practice guidelines, 11.5% of
our studied subjects had CKD. Individuals in CKD Stage 1 to 5 were 3.6%, 4.1%, 3.6%, 0.2% and 0.05%
respectively. Preliminary analysis of data from our epidemiology study shows that the prevalence of
hypertension is high and the awareness and treatment rate relatively low among residents of Shanghai.
It has been suggested that health education and hypertension screening programs should be conducted.

Survey in Multiple Renal Centers in Shanghai
We conducted an epidemiology study based on 5207 CKD patients from 15 renal centers in Shanghai. Our data
showed that 53.1% of all participants had hypertension. Hypertension ranked as the second leading cause of
CKD (11.9%) followed by primary glomerulonephritis (55.3%). As expected, we found that the prevalence of hypertension increased gradually with the decline of glomerular filtration rate (patients in CKD Stage 1 to Stage 5 were 26.7%, 42.5%, 52.5%, 59.7% and 66.8% respectively). By multivariate logistic regression analysis, older age (OR = 1.06, P <0.001), higher diastolic blood pressure (OR = 3.39, P = 0.002), later CKD stages (OR = 1.06, P <0.001) were associated with cardiovascular diseases (CVD). Moreover, we found that the hypertension control rate was significantly decreased along with an increasing severity of renal dysfunction (patients in CKD Stage 1 to Stage 5 were 67.8%, 52%, 50.9%, 40.3% and 26.6% respectively). Our study indicated hypertension is not only a major cause of renal injury but was also associated with a high risk of CVD in CKD patients. The very low control rate of hypertension in patients with advanced CKD aroused our attention to the necessity of strengthening the management of blood pressure in these patients.

Studies on the blood pressure variability

Blood pressure variability (BPV), a surrogate marker for the complex interaction between external and internal factors, has been identified as an independent predictor of cardiovascular mortality. We investigated the relationship between BPV and renal function based on a group of CKD patients. All patients in this study were between 16 to 75 years of age. Ambulatory BP monitoring (ABPM) was performed using a non-invasive monitor (SpaceLabs Medical Inc., Model 90219, Redmond, WA) and systolic BP (SBP), diastolic BP (DBP), mean arterial pressure (MAP) and heart rate (HR) were recorded. A total of 508 CKD patients were enrolled into the study; 318 were men and 190 were women. Compared to patients with mild-to-moderate renal function impairment, patients with severe renal dysfunction had higher SBP, more frequent non-dipper blood pressure and higher BPV (P <0.05). Moreover, we found higher BPV was associated with higher LVMI in CKD patients.

In addition, we looked at BPV in 131 CAPD patients and randomly selected 191 pre-dialysis Stage 5 CKD patients as controls. We found PD patients had higher SBP standard deviation (SBPSD), whether during the day or night, and had a higher ambulatory arterial stiffness index (AASI). A higher diagnosis rate of hypertension was reported by ABP than by office BP measurement both in pre-dialysis patients (92.31% vs 73.08%) and CAPD patients (93.19% vs 80.00%). By multivariate logistic regression analysis, we found higher daytime SBP (OR = 1.049 P <0.01), BMI (OR = 1.046 P <0.01) nighttime SBP (OR = 1.017 P = 0.043) and lower hemoglobin (OR = 0.961 P <0.01) were associated with increased risk of LVH. Moreover, we found higher daytime pulse pressure (Beta = 0.065 P <0.01) and non-dipper pattern (Beta = 1.646 P <0.01) were independent predictors for arterial stiffness assessed by carotid-femoral pulse wave velocity (CF-PWV) in CAPD patients. Our studies determined that ABP is a powerful approach to evaluate the blood pressure status and it can help physicians obtain a full picture of the BP pattern in these patients. BP and BPV obtained from ABPM are highly correlated with cardiovascular diseases as well as arterial stiffness in both pre-dialysis and CAPD patients.

In summary, we have conducted a series of epidemiological and clinical studies which are focused on hypertension and its impact on kidney and cardiovascular damage based on general and CKD populations. Our data indicate that hypertension is a common and serious issue in CKD patients that we should pay more attention to in our clinical practices. Meanwhile we should strengthen the clinical and basic research in this area. Under the support from the National Key Technology R&D program (2011BAI10B06), we have started serial national-wide clinical studies focusing on hypertension and target organ injury in CKD patients by collaborating with more than thirty renal centers around the country. The aim of this study is to investigate the prevalence, awareness and treatment of hypertension in a CKD population through an extended cross-sectional survey; to evaluate the target for hypertension control by a cohort study based on CKD patients with 3-year follow-up and to explore a hypertension management model based on monitoring the patients’ BP by integrating home BP measurement (HBPM), ABPM and office BP measurement. Hopefully, through our studies, we will be able to elucidate the status of treatment and prevention of hypertension and find a way to strengthen hypertension monitoring and improve its clinical outcomes in Chinese CKD patients.

Department of Nephrology of the Chinese PLA General Hospital

Department of Nephrology of the Chinese PLA General Hospital, led by the director, Prof. Xiangmei Chen, is a renowned institution for research on hypertension in chronic kidney disease (CKD) in China, which has been nominated as the National Clinical Research Center for Kidney Disease, the State Key Laboratory of Kidney Disease and the National Medical Quality Control Center for Kidney Disease.
From 2009 to 2010, an epidemiological survey of Prevalence, Awareness and Treatment Rates in Chronic Kidney Disease Patients with Hypertension in China (PATRIOTIC) was initiated. The study reported that the prevalence, awareness, and treatment of hypertension in non-dialysis CKD patients were 67.3, 85.8 and 81.0%, respectively. Of hypertensive CKD patients, 33.1% had controlled BP less than 140/90 mmHg and 14.1% under 130/80 mmHg. These results showed that although the awareness and treatment of hypertension is gradually improved, the control of hypertension in Chinese CKD patients is still suboptimal. In the PATRIOTIC study, the prevalence, awareness and treatment of hypertension in CKD patients aged 60 or older were 82.0, 90.7, and 87.3%, respectively. The control of hypertension at a BP of less than 140/90 mmHg was 29.6% and less than 130/80 mmHg 12.1%. No significant differences were noted among individuals with CKD within the different age groups: 60 to 69, 70 to 79, and 80 and above. However, the proportion of uncontrolled isolated systolic hypertension in elderly CKD patients increased with age.

In 2010, the Department of Nephrology of the Chinese PLA General Hospital established the Chinese National Renal Data System (CNRDS) (http://www.cnrds.net/) as the lead institution. Almost all hemodialysis centers in China were enrolled. By the end of 2012, 280,000 patients undergoing maintenance hemodialysis in 3000 hemodialysis centers were recorded. According to the 2012 CNRDS report, hypertensive nephropathy was the third leading cause of Chinese patients undergoing hemodialysis (10.1%), in which glomerulonephritis (58.1%) remained the first and diabetic nephropathy (16.5%) the second. Only 36.8% of the participants had a BP under 140/90 mmHg before hemodialysis.

In order to improve hypertension treatment and control of CKD patients, Prof. Chen has initiated a collaboration between several expert Chinese nephrologists to compose various papers including "Treatment of hypertension using long-acting dihydropyridine calcium channel blockers in patients with chronic kidney disease", "The use of angiotensin II receptor blockers in chronic kidney disease" and "Treatment of hypertension using α/β blockers in patients with chronic kidney disease".

In conclusion, the current status of the treatment and control of hypertension in Chinese CKD patients is unsatisfactory. The National Clinical Research Center for Kidney Disease, Department of Nephrology of the Chinese PLA General Hospital will continue to play a pioneer role in improving the management and control of hypertension in cooperation with kidney research institutions around the world, so as to reduce the cardiovascular comorbidities and improve the prognosis of Chinese CKD patients.

Division of Nephrology, Department of Medicine, Huashan Hospital, Fudan University

The investigators at the Division of Nephrology, Huashan Hospital have a long-time interest in understanding the role of the kidney in maintaining body fluid homeostasis and systemic blood pressure as well as how blood pressure may affect the kidney. Our research focusing on hypertension includes the role of renal prostaglandins in blood pressure regulation; the role of renin-angiotensin-aldosterone on blood pressure and renal damage and the role of endothelin on blood pressure regulation.

The biology of prostanoids in the kidney and their role in blood pressure regulation: As has been demonstrated in clinical studies and animal experiments, the inhibition of prostaglandin production using NSAIDs is associated with increased blood pressure or compromised blood pressure control in those who are on blood pressure-lowering medications. Our studies and others have shown that when following a high-sodium diet, cyclooxygenase-2 expression is markedly induced in the renal medulla, an area that is critical for blood pressure control. NFkB and CEBP/b signaling pathways play an important role in mediating COX2 induction following a high-sodium diet or during hypertonic stress. Further studies suggest that prostaglandin E2 (PGE2), produced in the renal medullary interstitial cells, may activate its EP2 receptors located at the tubular epithelial cells and promote natriuresis, thus maintaining sodium homeostasis in the body. Increased COX2 expression has also been shown to increase renal medullary blood flow, which may be associated with enhanced sodium excretion. Finally, renal medullary COX2 expression has also been shown to play an important role in maintaining the viability of the cells in the renal medulla, particularly in such conditions as dehydration, when a severe hypertonicity is produced in the renal medulla. These studies shed light on an important role of renal medullary COX2 in the regulation of sodium balance.
The role of the renin-angiotensin-aldosterone system (RAAS) in renal damage and blood pressure: It has been well documented that RAAS plays an important role in maintaining homeostasis and in the pathogenesis of certain disease processes such as hypertension, podocyte damage and decline of renal function in chronic kidney disease. Our studies identified several factors that may modulate RAAS activity under disease conditions. These factors include all-trans-retinoic acid, protein diet and PPARγ. Although the AT1 receptor has been shown to mediate the pathologic action of angiotensin II, our studies using a chimeric AT1 receptor knockout mouse model shows that glomeruli lacking AT1R have worse sclerotic damage. The mechanism underlying this is under investigation. We also examined the role of Ang-(1-7) in kidney disease. Our data show Ang-(1-7) has a beneficial effect on kidney disease and could be a potential therapeutic target. Aldosterone is a down-stream effector of RAAS. Our studies show that access aldosterone causes not only hypertension but also renal damage such as renal fibrosis, glomerular sclerosis and apoptosis. ER stress, NHE and NFκB in addition to mineral corticoid receptor may mediate the effect of aldosterone. Along with aging and an increased prevalence of metabolic syndrome, which are associated with increased hypertension, we are also currently actively investigating the relationship between aging and/or metabolic disorder and renal sodium balance and systemic blood pressure.

The Institute of Nephrology, Zhong Da Hospital Affiliated with Southeast University

The Institute of Nephrology, Zhong Da Hospital Affiliated with Southeast University is located at the center of Nanjing, the capital city of Jiangsu Province, China. As the key medical facility in Jiangsu Province, it is one of the most important regional nephrology centers in China. In 1998, the institute established the renal sister center with the Institute of Nephrology, Cardiff University under the auspice of the International Society of Nephrology (ISN) COMGAM program, which had been upgraded to the category A by the ISN after ten years of close collaboration and construction. Equipped with 70 beds and 105 hemodialysis stations, the institute provided a national leading standard clinical service to the patients. The current director of the institute is Professor Bi-Cheng Liu, who is now also serving as the Secretary General of the Chinese Society of Nephrology and Chairman of Jiangsu Province Society of Nephrology. The institute insists on patient-oriented service, and tries to afford a deep understanding about modern nephrology through the active teaching and research activities.

In recent years, the institute has focused on understanding the mechanisms of hypertension and its relevance to the progression of CKD and is supported by the Ministry of Science and Technology for the key basic research project (973), the key research program of the National Natural Scientific Foundation, etc. Specifically, we explored the maladaptive activation of the renin-angiotensin system (RAS) in hypertension and CKD. We demonstrated that Ang II induced lipid accumulation in human mesangial cells (HMCs) through the disruption of the low-density lipoprotein receptor (LDLr) pathway and lipid loading which activated the intracellular RAS to induce phenotypic changes and dysfunction in human mesangial cells (HMCs) (Ma KL, et al. Int J Med Sci, 2013. Ni J, et al. Lipids Health Dis, 2013). Furthermore, our study showed that inflammation and dyslipidemia played crucial, synergistic roles in the progression of atherosclerosis (Ma KL, et al. Int J Med Sci, 2013, Ma KL, et al. Int J Cardiol, 2013, Ma KL, et al. Cardiovasc Res, 2013). Additionally, as we know, endothelial injury plays an important role in hypertension and diabetic nephropathy. We found that high glucose (HG) stimulated Ang II synthesis in human endothelial cells. When endothelial cells were exposed to HG, some of them acquired a spindle-shaped morphology and demonstrated a loss of CD31 labeling, which was attenuated by irbesartan treatment (Tang RN, et al. Int J Cardiol, 2013). We also found that high glucose (HG) upregulated sterol regulatory element-binding protein (SREBP) 2-mediated cholesterol uptake through retinoblastoma protein phosphorylation (Ma KL, et al. Int J Cardiol, 2013). Additionally, we know, endothelial injury plays an important role in hypertension and diabetic nephropathy. We found that HG induced EndMT could be transitioned into mesenchymal stem cells and differentiated into chondrocytes promoting diabetic vascular calcification (Tang RN, et al. Cardiovasc Diabetol, 2012, Wu M, et al. Am J Physiol Renal Physiol, 2013).
The Division of Nephrology at Zhongshan Hospital, Fudan University contributes greatly to the development of blood purification in China. The division started research on dialysis, as well as the clinical application of peritoneal dialysis, in the 1960s. In 1973, the division performed the first maintenance hemodialysis in China, followed by the first case of hemoperfusion, which served as an artificial liver in 1978, and the first CAVH treatment in 1985. With experience in the field of blood purification techniques, our former leaders introduced a variety of CRRT techniques to China, presided over 30 academic conferences and CME programs on blood purification and contributed greatly to the implementation and development of blood purification in China. The division consists of an inpatient ward with 86 beds, a dialysis center equipped with over 100 hemodialysis machines and an outpatient clinical center, handling over 180 000 outpatients, 3000 ward patients, 500 maintenance hemodialysis patients and 200 peritoneal dialysis patients annually. The research work of the department is mainly focused on (1) Prevention and treatment of AKI, demonstrating the important role of NFkB in the pathogenesis of AKI, the "double-edged" nature of HIF in kidney diseases, the role of microRNA (miR-21/-29 etc.) in renal ischemic injury, uncovering the mechanism of renal ischemic preconditioning [Jia P, et al. PLoS One, 2013; Jia P, et al. Anesthesiology, 2013; Fang Y, et al. Am J Physiol Renal Physiol, 2013; Xu X, et al. Kidney Int, 2012; Cao CC, et al. Kidney Int, 2004]; (2) Hypertension and CVDs in HD. Cardiovascular and cerebrovascular diseases (CVD) are extremely prevalent in MHD patients and are the leading cause of death in these patients, in China, which account for nearly 40% of all deaths [Shanghai Dialysis Registry Report. http://sh.cnrrds.org, 2013]. The risk factors for CVD in HD patients are very complex and can be divided into traditional and non-traditional risk factors. Our study also confirmed that inflammation and hypertension were the important risk factors of CVD in hemodialysis patients in China. We found [Xu Y, et al. Renal Fail. 2011] that plasma pentraxin 3 (PTX3) levels, a new inflammatory biomarker, were markedly elevated in HD patients. High plasma PTX3 (>1.87ng/mL) level was positively and independently associated with CVD (OR = 3.15, p = 0.024). Left ventricular hypertrophy (LVH) is another common complication that contributes substantially to high cardiovascular mortality and morbidity in ESRD. We found [Cao X, et al. Ren Fail. 2011] that systolic blood pressure (SBP) independently correlated with LVH and left ventricular mass index (LVMI), which suggests that the ideal blood pressure control can reduce the risk of LVH. However, in China, blood pressure control in hemodialysis patients is not ideal. A cross-sectional survey [Lin J, et al. Chin J Intern Med. 2010] among 1382 maintenance hemodialysis patients from 11 hemodialysis centers in Shanghai revealed a hypertension prevalence of 86.3%, a treatment rate of 96.8%, while the control rate (pre-HD BP <140/90mmHg) is only 25.5%. Therefore, new technologies such as bioelectrical impedance for body water measurement and 48-h ambulatory blood pressure tests were introduced to clinical practice for accurate assessment of dry weight and good control of blood pressure. Residual daily urine volume in HD patients is one of the important factors affecting blood volume, the latter of which is closely related to the level of blood pressure. Our data suggested [Chen Y, et al. Clinical Neurology and Neurosurgery. 2013] that a 24-h residual urine volume <1290 mL at HD initiation was a significant predictor for future acute ischemic stroke occurrences during HD. Besides, we also found [Chen Y, et al. Am J Nephrol. 2011] that serum uric acid was inversely related to acute ischemic stroke morbidity in HD patients. The above studies showed that 24-h residual urine volume at HD initiation and serum uric acid were both good predictors of acute ischemic stroke.

Nephrology Department, Renji hospital, Shanghai Jiao Tong University School of Medicine
Renji hospital, Shanghai Jiaotong University School of Medicine established in 1844, is well-known in China for its many medical specialties including nephrology. Renji hospital is one of the earliest hospitals to practice renal replacement therapy in China: hemodialysis (HD), peritoneal dialysis (PD), as well as renal transplantation and has run its PD program for 30 years and now has nearly 450 PD patients. It has held a successful national PD CME course annually since 1997 and is the PD training center of the Ministry of Health in China. It is a well-recognized high-quality PD unit with a high PD utilization rate, excellent patient and technique survival, low peritonitis rate and a well-documented good quality of life of the treated patients. The utilization rate is high in Renji Hospital, as reflected by the fact that more than 50% of new ESRD patients opt for PD as their preferred RRT modality, and 55% of all dialysis patients are treated with PD. Our previous cohort study showed that the 1-year and 5-year actuarial patient survival was 90 and 64% respectively, which compared favorably to that of the data from the US Renal Data System (USRDS) and many other reports especially with the long-term survival. In a more recent cohort of 339 incident PD patients recruited between 1 January 2005 and 31 December 2009, we found an acceptable patient and technique survival rate, even after the inclusion of patients dying or failing PD within 90 days. Compared to reports from other units, the PD outcome in Renji appears to be best in its class with a 1-year and 5-year patient survival rate of 93 and 71%, and a 1-year and 5-year technique survival of 96 and 82%, respectively. With the improvement in PD connectology and the now exclusive use of the twin-bag system, as well as a strong focus on training and continuous quality improvement (CQI), we have achieved a very low peritonitis rate: 1: 62.5 patient-months in the 2005-2009 cohort.

The Renji PD program is active in PD-related research, both in basic and clinical research, including the field of hypertension. Pulse pressure is one of important indexes that reflects arterial stiffness. It has been shown recently that pulse pressure is associated with adverse clinical outcomes in the general population and in HD patients. However, the association of pulse pressure with clinical outcomes in PD patients has not been completely understood. We estimated the predictors of pulse pressure and assessed whether it is associated with mortality in our PD patients. All patients aged 18 years or older that commenced PD between 1 January 2000 and 31 December 2009 with a PD duration longer than 6 months in Renji Hospital were enrolled and followed up closely to 31 December 2010. A total of 498 PD patients were included (males 218, 43.8%). Among these patients, 423 (84.9%) had hypertension as comorbidity, 401 (80.5%) patients were taking hypertensive medication, among whom 341 (68.5%) were being treated with calcium channel blockers, 278 (55.8%) with an ACEI or an ARB, 120 (24.1%) with beta blockers. The study population had a mean systolic blood pressure of 143.1 ± 21.3 mmHg and diastolic blood pressure of 86.0 ± 11.8 mmHg during the first 6 months after initiation of PD. Mean baseline pulse pressure was 57.5 ± 16.5 mmHg. After adjusting for the demographic and clinical parameters, age (B = 2.34, P <0.001), serum albumin (B = 0.235, P = 0.004) and diabetes (B = 4.93, P <0.001) were significant predictors of elevated pulse pressure. Univariate analysis showed a direct and consistent association between pulse pressure and all-cause death (HR = 1.017, 95% CI 1.007-1.027, P <0.001) and cardiovascular death (HR = 1.016, 95% CI 1.003-1.030, P = 0.019). However, pulse pressure was not associated with all-cause death (HR = 1.019, 95% CI: 0.996-1.043, P = 0.104) and cardiovascular death (HR = 0.988, 95% CI 0.860-1.136, P = 0.870) in a multivariable Cox proportional hazards model. Our study suggested prevalence of hypertension was high in Chinese PD patients. Pulse pressure is not associated with all-cause or cardiovascular death in Chinese PD patients. Clearly, we need further prospective, randomized, controlled studies to confirm our findings.

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The Fifth Hospital affiliated with Shanghai Fudan University is a major renal center located in the Shanghai Minhang District. Hypertension (HTN) is a severe public health problem with increasing prevalence in the Shanghai Minhang District, as well as nationwide. With the full adoption of health information technology, the Minhang District began to establish the management system for hypertension (MSH) with the support of the Health Administration Office and the Government of the Minhang District in 2005, and became a national paradigm of chronic disease management network in 2007. The MSH implements the Community Health Service Center (CHSC), Center for Disease Prevention (CDC) and Control-General Hospital Trinity Health Management module and takes a grading management approach in which patients are divided into three groups, namely Low-risk group, Medium-risk group and High-risk group according to cardiovascular risk stratification standards. These management standards and requirements, formulated on the basis of HTN prevention and treatment guidelines and carried out in 2010 among groups are not exactly the same. The information platform is the key point and core of the MSH, and is linked with 13 CHSCs and two secondary health care center networks in the Minhang District. All of the information could be transmitted to the platform automatically, in real-time and with accuracy. The three main aspects of the information in the system are as follows: (1) registered information which records birth family history lifestyles current symptoms, risk factors target organ damage, definitive diagnosis time etc.; (2) follow-up records include blood pressure control level, current symptoms, physical examinations, risk factors target organ damage and routine tests and therapy. Generally, routine tests include creatinine, lipids, urinalysis, blood glucose, hematocrit, albumin/creatinine ratio, electrocardiogram and chest radiograph and are checked at least once a year; physical examinations include height, weight and body mass index which are checked at least semiannually; (3) assessments automatically conducted by the system at the end of the year include grading assessment management effect evaluation and follow-up plan development. In order to ensure maximum management efficiency specialized quality control groups are formed to monitor CHSC performance and ensure timely adjustment; the Department of Health of Minhang District places a high priority on the prevention and control of chronic diseases and provides special funding; the entire region implements the performance appraisal system in chronic disease management.

So far, about 190 000 patients have been included in the MSH, and the management rate of hypertension patients in Minhang District has reached 98.3%. Our preliminary analysis of patients with hypertension in the MSH from January 2005 to October 2012 showed that (1) the total number of patients under management is 180 804, with elderly individuals aged 60+ comprising the largest proportion (33.36%) and with individuals aged 50 to 59 years as the second largest proportion 20.87%; (2) the control rate of blood pressure is much higher than before; (3) main risk factors for HTN are smoking, alcohol intake, overweight/obesity, diabetes, low education and lack of physical activities; (4) HTN control is positively related to the choice of antihypertensive drugs and the frequency of clinical follow-ups; (5) stroke is still the most common complication of hypertension, while the second and third are cardiovascular and kidney disease, respectively; (6) the prevalence of CKD, proteinuria and reduced renal function in patients with hypertension is 34.49, 12.1 and 27.9%, respectively; the prevalence of CKD stage 1 to 5 is 52.0, 40.0, 7.2, 0.3, and 0.6%. All of the findings are in general consistent with other hypertension surveys conducted in China.