

The Risk Factors of Chronic Kidney Disease among Nursing Home Residents

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ABSTRACT

Background: The prevalence of end-stage renal disease in Taiwan is the highest in the world; haemodialysis accounts for about 7% of the expenditure of the National Health Insurance. Nursing home residents with chronic kidney disease (CKD) have not been identified yet in Taiwan, along with associated risk factors. The objective of this study is to investigate the risk factors of CKD in long-term care facilities in Taiwan and those significantly associated with the presence of CKD.

Methods: The nursing home residents who received health examination between January and June 2012, age ≥ 55 years, were enrolled in this study. They were categorized into two subgroups according to estimated glomerular filtration rate (eGFR): < 60 and ≥ 60 mL/min. Risk factors were evaluated per recommendations from the National Kidney Foundation: body mass index (BMI), waist circumference, blood pressure, fasting glucose and lipid profile. Metabolic syndrome among the residents was also identified.

Results: Fifty-three nursing home residents were enrolled in the final study; 16 (30%) had eGFR below 60 mL/min, and nine (56%) of them had BMI higher than 25 kg/m². The residents with advanced CKD had significantly higher BMI, triglyceride and lower high-density lipoprotein (HDL). Twelve (75%) had metabolic syndrome. Central obesity was observed in 10 (63%) with advanced CKD.

Conclusion: Most of the nursing home elderly with advanced CKD have poor control of associated risk factors, including obesity, hypertension, dyslipidaemia and hyperglycaemia. For them, metabolic syndrome may be a major contributant to the aetiology. Monitoring their BMI and waist circumference is a simple but effective way to suspect the presence of CKD.

Keywords: Chronic kidney disease, elderly, nursing home

Los factores de riesgo de la enfermedad renal crónica entre los residentes de hogares de ancianos

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RESUMEN

Antecedentes: La prevalencia de la enfermedad renal en fase final en Taiwán es la más alta del mundo. La hemodiálisis representa alrededor del 7% del gasto del Seguro Nacional de Salud. Los residentes con enfermedad renal crónica (ERC) y los factores de riesgos asociados, no han sido identificados todavía en los hogares de ancianos de Taiwán. El objetivo de este estudio es investigar los factores de riesgo de ERC en instalaciones de cuidado a largo plazo de Taiwán, y aquellos asociados significativamente con la presencia de ERC.

Métodos: Los residentes de hogares de ancianos que recibieron examen de salud entre enero y junio de 2012, edad ≥ 55 años, fueron alistados en este estudio. Se clasificaron en dos subgrupos según la tasa estimada de filtración glomerular (TFGe): < 60 y ≥ 60 mL/min. Los factores de riesgo fueron evaluados según las recomendaciones de la National Kidney Foundation: índice de masa corporal (IMC), circunferencia de cintura, presión arterial, glucosa en ayunas, y perfil lipídico. También se identificó el síndrome metabólico entre los residentes.

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Resultados: Cincuenta y tres residentes de hogares de ancianos fueron registrados para el estudio final. Dieciséis (30%) presentaban TFGe por debajo de 60 ml/min, y nueve (56%) de ellos tenían un IMC superior a 25 kg/m². Los residentes con ERC avanzada tuvieron significativamente mayor índice de masa corporal, triglicéridos, y niveles más bajos de lipoproteína de alta densidad (HDL). Doce (75%) tuvieron síndrome metabólico. En 10 (63%) con ERC avanzada, se observó obesidad central. **Conclusión:** En los hogares de ancianos, la mayoría de los ancianos con ERC avanzada presentan pobre control de los factores de riesgo asociados, incluyendo obesidad, hipertensión, dislipidemia e hiperglucemia. En sus casos, el síndrome metabólico puede ser un factor contribuyente en la etiología. El monitoreo de su índice de masa corporal y la circunferencia de la cintura, es una forma sencilla pero eficaz para determinar la presencia de ERC.

Palabras claves: enfermedad renal crónica, ancianos, hogar de ancianos

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INTRODUCTION

Chronic kidney disease (CKD) has become a global health issue due to increasing patient numbers and poor prognosis. According to the United States Renal Data System (USRDS) annual reports, the prevalence of end-stage renal disease (ESRD) in Taiwan in 2009 was 2447 per million. It is the highest in the world. The incidence is 347 per million per year, only lower than that of the United States of America (USA). Systemic complications of CKD (eg cardiovascular and haematologic abnormalities) further burden the society. In Taiwan, haemodialysis accounts for approximately 7% of the expenditure of the National Health Insurance (1), not including other disbursement associated with CKD.

Chronic kidney disease is present in approximately 24% to 50% of the nursing home residents in the USA (2–5). They require more assistance in performing basic activities of daily living [ADL] (4) and their cognitive function declines faster, especially those who are older (6). The elderly with disabilities or chronic diseases that require long-term care are admitted to nursing home, along with those who are undergoing postoperative rehabilitation. Some people who persistently look after their elder family members may feel exhausted; they may also send the elderly to facilities for short-term respite care.

In the past, the elderly in Taiwan were respected and they usually lived with their family, who took care of them as a responsibility. However, the old population is gradually increasing, and socio-economic changes force the caregivers to share part of the obligation with facilities (7), which are managed by medical teams composed of doctors, nurses, nutritionists, physical therapists, pharmacists and social workers. As a consequence, nursing home residents increase gradually and daily conditions are mostly observed by nursing staff. Chronic kidney disease and its complications, such as anaemia and cardiovascular events, have been studied (2, 8). However, those with CKD have not yet been identified in Taiwan. They may have specific risk factors compared with those of Westerners due to different races and lifestyle.

The objective of this study is to investigate the risk factors of CKD in long-term care facilities in Taiwan and the signifi-

cant risk factors associated with the presence of CKD.

SUBJECTS AND METHODS

The residents from three nursing homes, who received health examination between January and June 2012, age ≥ 55 years, were included in this study. Body mass index (BMI), systolic and diastolic blood pressure, fasting glucose and lipid profile such as cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol and triglyceride were collected to evaluate risk factor control (eg obesity, hypertension, diabetes mellitus and dyslipidaemia) and relationship between CKD and those risk factors. Body mass index and blood pressure were measured within three months at the time of regular health examinations. The average of their blood pressure continuously recorded in the morning for seven days was used. Serum creatinine, fasting glucose and lipid profile were done at the health examination. Estimated glomerular filtration rate (eGFR) was calculated by the modification of diet in renal disease (MDRD) equation. Advanced CKD is defined as eGFR less than 60 mL/min. Nursing home residents fitting the inclusion criteria were separated into two groups: with or without advanced CKD.

Risk factors were evaluated by comparing BMI, systolic and diastolic blood pressure and LDL-cholesterol of those nursing home residents with the therapeutic goals in patients with diabetes and CKD recommended by the National Kidney Foundation (9). Chi-squared was used to identify the odds ratio.

Values of BMI, systolic and diastolic blood pressure, fasting glucose and lipid profile of nursing home residents with advanced CKD were presented as mean \pm standard deviation, which were compared with those without advanced CKD by Student's *t*-test. Statistical significance was considered as a value of *p* less than 0.05.

Patients with three of the five conditions: waist circumference more than 102 cm for men and 88 cm for women, triglyceride higher than 150 mg/dL, HDL cholesterol less than 40 mg/dL for men or 50 mg/dL for women, blood pressure higher than 130/85 mmHg and fasting glucose higher than 110 mg/dL were defined as having metabolic syndrome per the

National Cholesterol Education Programme Adult Treatment Panel III (ATP III) Report (10).

RESULTS

A total of 68 nursing home residents received health examination in 2012. Fifteen residents were excluded due to incomplete lipid profile; 53 elderly were enrolled in the final study. None of them received haemodialysis or kidney transplantation. Sixteen (30%) residents had estimated GFR less than 60 ml/min, belonging to the group of advanced CKD (Table 1). The mean age of advanced CKD and non-advanced CKD was 76.9 and 76.4 years, respectively. Men were fewer than women in both groups.

Table 1: The characteristics of nursing home residents

Risk factors	Advanced CKD	Non-advanced CKD	Odds ratio
Age, mean (year)	76.9	76.4	
55–64	1 (6.25%)	5 (13.5%)	
65–74	4 (25%)	7 (18.9%)	
75–84	10 (62.5%)	18 (48.7%)	
> 85			
Gender	1 (6.25%)	7 (18.9%)	
Male	4 (25%)	13 (35.1%)	
Female	12 (75%)	24 (64.9%)	
Obesity BMI > 25 kg/m ²	9 (56.3%)	5 (13.5%)	8.23
Hypertension			
Systolic BP > 130 mmHg	10 (62.5%)	25 (67.6%)	0.80
Diastolic BP > 80 mmHg	4 (25%)	13 (35.1%)	0.62
Dyslipidaemia			
LDL-C >100 mg/dL	9 (56.3%)	22 (59.5%)	0.88

CKD: chronic kidney disease; BMI: body mass index; BP: blood pressure; LDL-C: low-density lipoprotein

Among the residents with advanced CKD, 9 (56%) had BMI higher than 25 kg/m²; 10 (63%) had systolic blood pressure above 130 mmHg and 9 (56%) had LDL cholesterol higher than 100 mg/dL (Table 1). Only two (13%) of them achieved therapeutic goals in all risk factors. Prevalence of hypertension and high LDL cholesterol were similar in both groups; the odds ratio did not reach significance.

The residents with BMI higher than 25 kg/m² had higher risk for advanced CKD [OR 8.23, CI 2.10, 32.23, $p < 0.05$] (Table 1). Significantly higher BMI was observed in residents with advanced CKD (24.9 ± 4.2 kg/m²) than those without advanced CKD [21.9 ± 3.0 kg/m²] (Table 2), along with higher triglyceride (178.1 ± 87.8 mg/dL) and lower HDL cholesterol (36.8 ± 10.0 mg/dL). Three-fourths of residents with advanced CKD had metabolic syndrome [OR 4.40, CI 1.19, 16.28, $p < 0.05$] (Table 3), which was diagnosed in 15 (40%) of those without advanced CKD. According to their waist circumference, central obesity was observed in 10 (63%) residents who had advanced CKD (OR 4.50, CI 1.30, 15.63, $p < 0.05$).

Table 2: The risk factors of chronic kidney disease (CKD)

Risk factors (mean)	Advanced CKD	Non-advanced CKD	<i>p</i> -value
BMI (kg/m ²)	24.9 ± 4.2	21.9 ± 3.0	< 0.01
Waist circumference (cm)	97.9 ± 9.2	87.5 ± 9.9	< 0.01
Systolic BP (mmHg)	131.8 ± 13.7	132.3 ± 16.3	0.91
Diastolic BP (mmHg)	74.2 ± 6.7	76.9 ± 7.4	0.22
Glucose AC (mg/dL)	121.2 ± 40.1	102.4 ± 36.6	0.10
Cholesterol (mg/dL)	174.9 ± 51.9	177.8 ± 35.9	0.81
HDL-C (mg/dL)	36.8 ± 10.0	45.7 ± 14.0	0.03
LDL-C (mg/dL)	114.8 ± 59.6	109.6 ± 30.0	0.67
Triglyceride (mg/dL)	178.1 ± 87.8	108.4 ± 53.1	< 0.01

BMI: body mass index; BP: blood pressure; HDL-C: high-density lipoprotein; LDL-C: low-density lipoprotein

Table 3: Nursing home residents who fit the criteria for metabolic syndrome

Number of criteria	Advanced CKD	Non-advanced CKD
0	0 (0)	2 (5.4%)
1	1 (6.25%)	15 (40.5%)
2	3 (18.8%)	5 (13.5%)
3	6 (37.5%)	10 (27%)
4	5 (31.2%)	2 (5.4%)
5	1 (6.25%)	3 (8.2%)

CKD: chronic kidney disease

DISCUSSION

Cardiovascular disease risk factor control is recommended in CKD patients (9). Chronic kidney disease itself is reported to be associated with stroke (11). The National Kidney Foundation's Kidney Early Evaluation Program (KEEP) in 2005–2010 disclosed that 31.9% of participants with stage 4–5 CKD had three risk factors [hypertension, diabetes and hypercholesterolaemia] (12). In the present study, the prevalence of advanced CKD in nursing home residents is approximately 30%, but only 13% have optimal control of all risk factors (eg obesity, hypertension and dyslipidaemia). One study in Spain recruited people with recent coronary events; it was found that only 11.8% of them with CKD had cardiovascular disease risk factors all well controlled, though they were prescribed more diuretics, calcium channel blockers and angiotensin II receptor blockers than those without CKD (13). Physicians who care for nursing home residents should pay more attention to their achievement of therapeutic goals of cardiovascular disease for prevention of further events that impair ADL.

Cardiovascular disease risk factors are also related to incidence and progression of CKD (14). In the present study, the residents with advanced CKD have significantly higher BMI than those without advanced CKD. Most residents seldom ambulate, even with assisted devices, due to lower limb amputation, dementia, stroke, or other chronic diseases. Staying in wheelchairs may help them to prevent falls when they are not monitored by nursing staff. Therefore, poor physical activity is inevitable. Although body weight is regularly measured and diet is designed by a nutritionist, about 26% of elderly people are overweight or obese during nursing home residency. In the USA, more than 25% of older nursing home residents were obese at admission, and the percentage kept increasing (15).

For elderly members of the Kaiser Permanente Medical Care Plan followed for five years, the risk ratio of nursing home admission related to obesity in their 50s are 1.34 in whites and 1.15 in blacks (16). Another study in the USA also disclosed that reduction of kidney function in nursing home residents is associated with obesity, regardless of gender (17).

Except for higher BMI, nursing home residents with advanced CKD have significantly higher triglyceride and lower HDL cholesterol. The present study also shows that nursing home residents with advanced CKD have higher fasting glucose (121.2 ± 40.1 mg/dL) than the rest (102.4 ± 36.6 mg/dL), though the values do not reach significance ($p = 0.10$). Fasting glucose over 100 mg/dL is observed in approximately 63% of the residents with advanced CKD, whether they are on anti-diabetic agents or not.

An analysis by the National Health Insurance of Taiwan showed that about 20% of patients receiving haemodialysis had diabetic nephropathy. Pooled prospective cohort studies found an odds ratio of 1.55 for advanced CKD related to metabolic syndrome (18). Three-fourths of nursing home residents with advanced CKD had metabolic syndrome, as well as 41% of those without advanced CKD. One study conducted in Taiwan enrolled elderly people who received voluntary health examination, and found that metabolic syndrome had a 1.88-fold increased odds ratio of CKD after adjusting for confounding factors (19). Furthermore, increased odds ratio of prevalent CKD is associated with each criterion for metabolic syndrome (19). Among the five criteria, central obesity is observed in 63% of residents with advanced CKD, significantly higher than those without advanced CKD. The question of how CKD results from metabolic syndrome has been proposed through several mechanisms relating to renin-angiotensin-aldosterone system [RAAS] (20). For nursing home residents in Taiwan, metabolic syndrome may most appropriately explain the aetiology of CKD, rather than any single risk factor.

The limitation of this study is exclusion of residents who did not receive health examination or had incomplete lipid profile. The former may be repeatedly hospitalized due to complications of chronic diseases or rarely followed-up at the outpatient department for personal reasons, and the latter may be considered relatively lower risk for cardiovascular disease. More nursing home residents may be recruited to further reflect the virtual condition.

CONCLUSION

Most of the nursing home elderly with advanced CKD have poor control of associated risk factors, including obesity, hypertension, dyslipidaemia and hyperglycaemia. Physicians in long-term care facilities should manage those risk factors actively. Furthermore, metabolic syndrome seems to contribute the most to CKD in nursing home residents. Monitoring BMI and waist circumference is considered a simple but effective way to suspect the presence of CKD.

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