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Comparison of atrial fibrillation in CKD and non-CKD populations: A cross-sectional analysis from the Kailuan study

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ABSTRACT

Objectives: To compare clinical epidemiological features of atrial fibrillation (AF) in chronic kidney disease (CKD) and non-CKD populations.

Methods: This study included 88,312 adults aged ≥45 years old from the KAILUAN study. AF was ascertained with a 12-lead electrocardiogram. CKD was defined as an estimated glomerular filtration rate (eGFR) < 60 mL/min/1.73 m^2 and/or proteinuria. Participants were categorized into non-CKD (eGFR > 60 mL/min/1.73 m^2 without proteinuria, n = 66,725) and CKD (n = 21,578) groups. We evaluated the prevalence of AF in both groups, evaluated risk factors for AF using multivariable-adjusted logistic regression analysis.

Results: The prevalence of AF among non-CKD and CKD participants was 0.26% and 1.00%, respectively. Multivariable-adjusted analysis showed that older age (odds ratio [OR]: 1.08, 95% confidence interval [CI]: 1.07–1.10, P < 0.001), smoking (OR: 1.23, 95% CI: 1.07–1.57, P = 0.017), hypertension (OR: 2.14, 95% CI: 1.44–3.17, P < 0.001), diabetes (OR: 1.79, 95% CI: 1.10–2.89, P < 0.001), and larger waist circumference (OR: 1.03, 95% CI: 1.01–1.04, P < 0.001) were significantly associated with AF in the non-CKD group. In the CKD group, older age, smoking, larger waist circumference, reduced eGFR (OR: 0.97, 95% CI: 0.95–0.99, P < 0.001), proteinuria (OR: 2.01, 95% CI: 1.09–3.74, P < 0.001) and raised serum C-reactive protein (1.01, 1.00–1.03, P < 0.001) were significantly associated with AF.

Conclusions: The prevalence of AF in Chinese adults with CKD is higher than that among those without CKD. Risk factors for AF in non-CKD population were not the same compared with those in CKD population, kidney function and inflammatory markers were associated with the prevalence of AF.

1. Introduction

Atrial fibrillation (AF) is a common cardiac arrhythmia which has been proven to be an independent risk factor for ischemic stroke and all-cause mortality [1]. The incidence of AF increased rapidly in the last decades and it is estimated that 5.6 million people are expected to be affected by the year 2050 in the United States [2]. In China, the estimated prevalence of AF in the general adult population was 0.78% in 2013, with approximately 3.9 million individuals aged ≥60 years affected; This number is expected to reach 9 million patients by 2050 [3,4].

Chronic kidney disease (CKD) is also an important public health problem in the Chinese population with a prevalence of about 10.8% in 2010 [5]. Previous studies have investigated multiple underlying risk factors for both AF and CKD including hypertension, diabetes mellitus and coronary artery disease (CAD). Therefore, understanding the prevalence and associated risk factors for AF in the CKD population has important public health and clinical implications [6]. However, most AF-related studies to date have focused on individuals with end-stage kidney disease, among whom the incidence of AF is much higher, and who also have more severe adverse outcomes in contrast to that in individuals with normal kidney function [7,8].

Currently, there is still limited data regarding the features of AF in Chinese patients with some early stages of CKD. Therefore, we performed a cross-sectional study to investigate the clinical epidemiological features

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of AF in Chinese patients with and without CKD enrolled from the KAILUAN study.

2. Patients and methods

2.1. Study population

We conducted a cross-sectional study of Chinese adults aged45 years and older, enrolled in the KAILUAN study between January 8, 2008 and December 31, 2015. All data was obtained from the KAILUAN Health and Wellness Registry file (Registration number: ChiCTR-TNRC-11001489) [9]. The KAILUAN study is a prospective study started in 2006, new participants have been enrolled every year since the start of the study, and all participants were followed biennially to update information on potential risk factors and new diagnoses. These de-identified secondary data include all registry and claims data, ranging from demographic data, medical history, physical examination, and laboratory examination to detailed orders from ambulatory and inpatient care. Diseases are coded according to the International Classification of Diseases, Ninth Revision, and Clinical Modification (ICD-9-CM). This study was approved by the Tangshan Kailuan Hospital Ethical Review Board and informed consent was waived because unidentified information was used in the study [10].

During the accrual period, a total 126,836 participants were recruited in the study; in the current analyses, 37,806 participants younger than 45 years old were excluded. We further excluded 676 participants with missing or invalid baseline data and 42 participants with a history of kidney transplantation or dialysis therapies. After these exclusions, a total of 88,312 men and women 45 years and older remained in the analysis, including 21,587 participants with CKD (eGFR < 60 mL/min per 1.73 m^2; eGFR ≧ 60 mL/min per 1.73 m^2 and existence of proteinuria at entry based on urine dipstick results and quantified as 1+, 2+, 3+, or 4+) and 66,725 participants without CKD (eGFR ≧ 60 mL/min per 1.73 m^2 and proteinuria negative) (Fig. 1).

2.2. Ascertainment of AF

AF was diagnosed based on electrocardiogram (ECG) criteria in this analysis. Standard 12-lead ECGs were recorded in all participants by strictly standardized procedures at baseline. The ECGs were read and analyzed using Minnesota ECG classification [11] at the KAILUAN General Hospital diagnosis center by electro-cardiographers, and AF was defined as presence of AF in the baseline ECGs.

2.3. Other covariates

Entry data of the participants were used as baseline data. Participants provided details of their socio-demographic characteristics and medical history to a trained interviewer at each clinical examination. Anthropometric measures including height, weight, waistline, and standardized blood pressure [BP] measurements were obtained. Hypertension was defined as systolic blood pressure (SBP) > 140 mm Hg, diastolic blood pressure (DBP) > 90 mm Hg, or self-reported use of antihypertensive medications. Diabetes was defined as a fasting glucose > 126 mg/dL, random glucose > 200 mg/dl, or use of insulin or other anti-diabetic medication. For the diagnosis of congestive heart failure (HF), a physician's diagnosis was followed by a review of the participant's medical records, consideration of symptoms, signs, chest x-ray findings, and treatment of HF. Myocardial infarction (MI) was defined from hospital records by the clinical history of cardiac symptoms, cardiac enzymes, and serial electrocardiogram changes. Peripheral atrial disease (PAD) were identified by International Classification of Diseases, Ninth Revision, clinical Modification procedure codes for lower extremity bypass surgery, major lower extremity amputation, and peripheral angioplasty. Blood samples were processed and analyzed using an auto-analyzer (Hitachi 747; Hitachi, Tokyo, Japan) in the central laboratory of Kailuan General Hospital. Laboratory values of interest included serum creatinine (SCr), total cholesterol (TC), low density lipoprotein (LDL) cholesterol, high density lipoprotein (HDL) cholesterol, triglycerides (TG), and novel cardiovascular risk factors (i.e., C-reactive protein [CRP]); all analyses were performed at the Kailuan General Hospital Laboratory [12]. eGFR was calculated using the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) creatinine equation with an adjusted coefficient of 1.1 for the Asian population [13], and categorized as >90, 60 to <90, 30 to <60, and <30 mL/min/1.73 m^2 [14]. Proteinuria was defined based on urine dipstick analysis using an automated dipstick urinalysis (H12-MA, DIRUI N-600) and quantified as none/trace, 1+, 2+, 3+, or 4+. We defined urine protein positive as 1+ or greater protein [15]. For the multivariate models, BP was included as a categorical variable and as the systolic and diastolic BP reading.

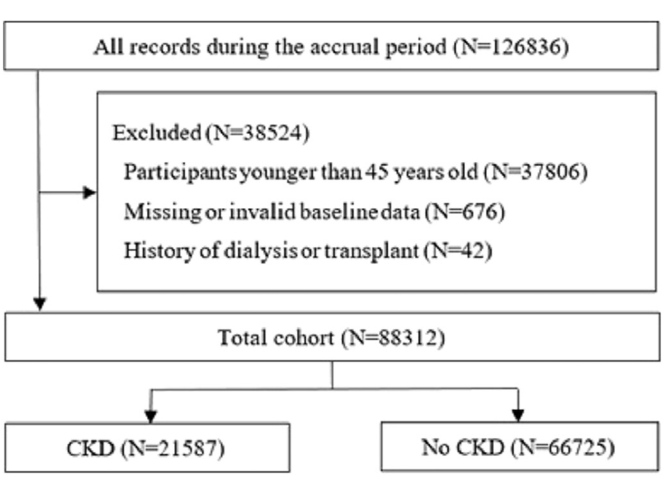

Fig. 1. Flowchart of participant selection.

2.4. Statistical analysis

Frequency distributions of all variables were first inspected to identify anomalies and outliers possibly caused by measurement artifacts. Continuous data were expressed as mean and standard deviation (SD) or median (interquartile range [IQR]), and categorical data as proportions (percentage).

Participant characteristics and the prevalence of ECG-detected AF were stratified by CKD stage. The statistical significance of linear trends for participant characteristics across CKD stages was tested by linear and logistic regression for continuous and dichotomous variables, respectively. The gender, age, clinical history, and waist circumference specific prevalence of ECG-detected AF were presented according to CKD status. The unadjusted and adjusted odd ratios (ORs) for prevalent AF associated with CKD (eGFR ≥ 60, 30 to <60, and <30 mL/min/1.73 m^2) versus non-CKD were calculated using logistic regression (Model I was un-adjusted; Model II included adjustment for age and sex; Model III included additional adjustment for other potential confounders, including clinical history of smoking, alcohol intake, hypertension and diabetes; Mode IV included all adjustment except for eGFR and urine protein). The multivariable-adjusted ORs for prevalent AF associated with CKD status were calculated using logistic regression within participant subgroups according to gender, age, obesity, and clinical history. Finally, the multivariable-adjusted ORs for prevalent AF associated with demographics and clinical risk factors were calculated for all participants, CKD and non-CKD groups, separately. The interaction terms (e.g. eGFR or urine protein positive ∗ history of hypertension or diabetes mellitus) were incorporated into the multivariable model.

All statistical tests were evaluated using two-tailed 95% confidence intervals (CI), and data analyses were performed using Stata version 14.2 (STATA, College Station, TX). $P < 0.05$ was considered statistically significant.

3. Results

3.1. Baseline characteristics of the study population

Baseline characteristics were compared between the CKD group and non-CKD group (Table 1). Participants with more advanced CKD were older and more likely to have a lower education level. Smoking, alcohol intake, hypertension, diabetes, myocardial infarction, congestive heart failure, and peripheral artery disease were more frequent, and larger waistline circumference, higher SBP and DBP were more common among individuals with more advanced CKD. The proportion of old people who is older than 65 years old in non-CKD population was lower than that in CKD population, and the constituent ratios of old age individuals were increased with the kidney function reduced. Additionally, serum levels of TG, CHOL, LDL, and CRP were higher, and serum level of HDL was lower among participants with progressively worsening kidney function.

3.2. Prevalence of AF in CKD and non-CKD populations

There were 390 (0.44%) cases of ECG-detected AF among the 88,312 qualified participants; of these, 174 (0.26%) cases of AF were identified in adults without CKD and 216 (1.00%) cases in adults with CKD. In sub-groups stratified by age, sex, diabetes, hypertension, and waist circumference, the prevalence of AF in participants with CKD was significantly higher than in those without CKD (Supplementary Table 1).

There were 106, 105, and 5 cases of ECG-detected AF among CKD adults with eGFR ≥ 60, 30 to <60, and <30 mL/min/1.73 m^2, respectively. The prevalence of AF increased significantly with worsening eGFR. Specifically, the prevalence of AF was 0.26% among adults with non-CKD, and 1.08%, 0.91%, and 3.21% among adults with eGFR ≥ 60, 30 to <60, and <30 mL/min/1.73 m^2, respectively. Compared with non-CKD participants, the unadjusted ORs for AF were 4.16 (95% CI, 3.27–5.30), 3.49

(95% CI, 2.74–4.46), and 12.66 (95% CI, 5.13–31.25) for those with CKD (eGFR ≥ 60, 30 to <60, and <30 mL/min/1.73 m^2), respectively. After adjustment for age and sex; for age, sex, and clinical history of smoking, alcohol intake, hypertension, diabetes, myocardial infarction, congestive heart failure and peripheral artery disease; and after further multivariable adjustment, these associations were attenuated but remained statistically significant (Table 2). We also calculated the multivariable-adjusted ORs of participants for prevalent AF associated with CKD versus non-CKD within subgroups stratified by age, diabetes, hypertension and waist circumference sex, the ORs in all subgroups were >1 (Supplementary Fig. 1).

3.3. Risk factors for the prevalence of AF

The multivariable-adjusted associations between demographic and clinical variables and prevalent AF of the participants in CKD and non-CKD groups are shown separately in Table 3. Regardless of CKD status, older age, smoking, and larger waist circumference were associated with an increased OR for AF. Among those without CKD, a clinical history of hypertension, diabetes and reduced eGFR were significantly associated with ORs for AF. Alternatively, among those with CKD, baseline elevated serum CRP, reduced eGFR, and urine protein positive were significantly associated with an increased OR for AF (Table 3). No significant interactions were observed between demographic and clinical variables and the baseline eGFR and urine protein (all P for interaction terms ≥ 0.10).

4. Discussion

In this community based cross-sectional analysis, we demonstrated that the prevalence of AF in the CKD and non-CKD groups was 1.0% and 0.26%, respectively. Notably, the prevalence of AF was significantly increased in patients with different stages of CKD compared with that in the non-CKD group. Our study also showed that older age, smoking, increased waist circumference, increased serum CRP, reduced eGFR, and proteinuria were associated with a higher risk of AF prevalence in CKD patients; alternatively, older age, smoking, increased waist circumference, hypertension and diabetes were independent risk factors for the prevalence of AF in non-CKD participants. To the best of our knowledge, this is the first large scale study to compare the different clinical epidemiological characteristics of AF in CKD and non-CKD populations in China.

Previous studies have indicated that ethnic and geographic differences exist in the prevalence of AF. For example, the estimated prevalence of AF in adults in Australia, Europe and the USA is 1–4% [16,17], compared to 0.5 to 0.7% in Asian countries such as Japan and Korea [18,19]. In this study, we found an overall prevalence of 0.44% in Chinese adults, which is similar to that in some other Asian countries, but lower than that in western countries. The exact reasons underlying the ethnic and regional variations in the prevalence of AF have not been clearly elucidated, but are probably attributable to differences in genetics, environmental factors, and study designs (e.g. differences in the methods used to diagnose AF, such as by ECG and/or self-report versus prior diagnosis). Explaining these underlying differences is beyond the scope of the current study, but should be evaluated in future studies.

In recent years, CKD has emerged as a major public health burden, and has been demonstrated to be an independent risk factor for the higher incidence and prevalence of AF [20–22]. However, the clinical epidemiological information of AF in CKD population remains limited, most related studies to date were focused on the end stage renal disease (ESRD) patients. The DOPPS investigators reported that the prevalence of AF in hemodialysis patients ranged from 11.3% to 24.7% in Western

Table 1
Baseline characteristics of participants according to eGFR stage.

Characteristic	Non-CKD n = 66,725	CKD eGFR (mL/min/1.73 m^2)			P value for trend
		≥60 n = 9850	30–59 n = 11,581	<30 n = 156	
Demographics					
Age (yr; mean ± SD)	57.28 ± 8.40	59.25 ± 9.39	62.35 ± 10.37	61.68 ± 11.75	<0.001
<65 years (%)	82.48%	75.09%	62.55%	67.31%	
≥65 years (%)	17.52%	24.91%	37.45%	32.69%	
Male gender (%)	81.47%	85.59%	75.26%	78.21%	<0.001
Education level (%)					<0.001
≤9 years (%)	83.38%	84.75%	85.07%	83.33%	
>9 years (%)	16.13%	12.96%	13.65%	14.10%	
Clinical history					
Smoking (%)	42.21%	42.42%	30.58%	31.41%	<0.001
Alcohol intake (%)	39.78%	37.07%	27.20%	28.21%	<0.001
Hypertension (%)	16.57%	23.73%	21.58%	28.21%	<0.001
Diabetes mellitus (%)	5.20%	9.25%	7.68%	14.74%	<0.001
Myocardial infarction (%)	3.02%	3.15%	3.76%	3.88%	<0.001
Congestive heart failure (%)	4.50%	4.55%	5.02%	5,65%	<0.001
Peripheral artery disease (%)	3.02%	3.40%	3.58%	3.86%	<0.001
Waist circumference (cm; mean ± SD)	87.98 ± 9.74	89.31 ± 10.23	87.08 ± 9.61	88.35 ± 11.09	<0.001
<85 cm (%)	36.35%	31.88%	42.12%	35.26%	
≥85 cm (%)	61.63%	64.01%	56.08%	62.18%	
SBP (mm Hg; mean ± SD)	133.63 ± 20.06	140.95 ± 22.96	138.38 ± 21.84	138.91 ± 22.35	<0.001
DBP (mm Hg; mean ± SD)	85.50 ± 11.27	88.63 ± 12.82	85.52 ± 11.58	85.69 ± 13.90	<0.001
LDL cholesterol (mmol/L; mean ± SD)	2.74 ± 0.75	2.87 ± 0.81	2.82 ± 0.74	3.09 ± 1.67	<0.001
HDL cholesterol (mmol/L; mean ± SD)	2.04 ± 0.25	2.05 ± 0.27	2.02 ± 0.17	2.05 ± 0.23	<0.001
TG (mmol/L; median [IQR])	1.59 ± 1.38	1.75 ± 1.63	1.67 ± 1.37	2.87 ± 2.96	<0.001
TC (mmol/L; median [IQR])	5.07 ± 1.00	5.17 ± 1.08	5.00 ± 0.94	5.13 ± 1.21	0.003
CRP (mg/L; mean ± SD)	3.11 ± 5.32	4.12 ± 6.87	3.54 ± 6.29	3.90 ± 7.09	<0.001
eGFR (ml/min/1.73 m^2; mean ± SD)	87.34 ± 14.78	85.29 ± 15.12	52.37 ± 6.17	25.59 ± 2.84	<0.001
Urine protein positive (%)	–	84.36%	14.05%	30.77%	<0.001

Note: Values for categorical variables are given as number (percentage); for continuous variables, as mean ± standard deviation or median [IQR].
Abbreviations: AF, atrial fibrillation; SBP, systolic BP; DBP, diastolic BP; TG, triglycerides. TC, total cholesterol; CRP, C-reactive protein; LDL, low density lipoprotein; HDL, high density lipoprotein; eGFR, estimated glomerular filtration rate.
Missing values (number missing): age, 0; gender, 0; education level, 104; smoking, 252; alcohol intake, 292; hypertension, 195; diabetes mellitus, 180; myocardial infarction, 162;congestive heart failure, 132;peripheral artery disease, 213; waist circumference, 205; SBP, 138; DBP, 138; LDL, 222; HDL, 198; TG, 188; TC, 196; CRP, 204; urine protein, 22.

Table 2
Prevalence and odds ratios (OR, 95% CI) for AF defined by ECG criteria.

	Non-CKD n = 66,725	CKD eGFR (mL/min/1.73 m^2)		
		≥ 60 n = 9850	30–59 n = 11,581	<30 n = 156
Cases of AF, n	174	106	105	5
Prevalence	0.26%	1.08%	0.91%	3.21%
OR (95% CI)				
I	1.00 (Referent)	4.16(3.27–5.30)[§]	3.49(2.74–4.46)[§]	12.66(5.13–31.25)[§]
II	1.00 (Referent)	3.37(2.63–4.32)[§]	2.15(1.68–2.76)[‡]	7.59(2.88–20.05)[§]
III	1.00 (Referent)	2.92(2.24–3.81)[‡]	2.03(1.57–2.62)[‡]	7.52(2.81–20.12)[§]
IV	1.00 (Referent)	2.98(2.25–3.94)[‡]	1.63(1.22–2.17)[‡]	3.33(1.76–14.58)[‡]

I = no adjusted.
II = adjusted for age, gender.
III = adjusted for age, gender, history of hypertension, diabetes, myocardial infarction, congestive heart failure, peripheral artery disease, smoking, and alcohol use.
IV = adjusted for all covariates except for eGFR and urine protein positive.
‡ P < 0.01.
§ P < 0.001.

countries, which was significantly higher than that in the general population [23]. Recently, a cohort from the REGARDS study which included 26,917 African-American and Caucasian US adults older than 45 years of age showed that the prevalence of ECG-detected AF was 1.0% among adults without CKD, and 2.8%, 2.7%, and 4.2% among adults with stage 1 to 2, stage 3, and stage 4 to 5 CKD, respectively. Compared to participants without CKD, the risk of AF was increased 1 to 3 fold among those with CKD [24]. These differences were similar in magnitude to the association between kidney function and the prevalence of AF in our study, we found a higher prevalence of AF in patients with CKD compared to those individuals without CKD, the highest prevalence of AF noted among those with stage 4 to 5 CKD (eGFR < 30 ml mL/min/1.73 m^2). Therefore, our findings extend previous observations about the situations of AF in different stages of CKD in a large population of Chinese adults.

In addition to evaluating the prevalence of AF, we also compared demographic and clinical risk factors for AF among participants with and without CKD. Previously established risk factors for AF in the general populations, such as advanced age, smoking, hypertension, and diabetes were also identified as risk factors for AF among the non-CKD participants in our study. However, risk factors for AF in the CKD population did not mirror those reported in the general population. Our multivariable logistic regression analysis revealed that in addition to some of the abovementioned classical risk factors, other CKD related variables such as elevated serum CRP, reduced eGFR and proteinuria were also independent risk factors for the prevalence of AF in our CKD population. It is also worth to mention that some early stages of CKD patients whose eGFR > 60 ml/min/1.73 m^2 with proteinuria also had significant increased prevalent rate of AF, which might indicate the important pathological role of proteinuria in the occurrence of AF. It seems that these risk factors that had been validated in our study might become potential interventional measures for the prevention of AF in CKD populations in the future.

No studies to date have clearly elucidated the pathophysiology underlying the association between AF and CKD [25]. Some studies have suggested that volume overload contributes to the development of AF in patients with ESRD [26]; however, this is unlikely to be the case in our study population, as among patients with early stage CKD, patients' blood pressure, which can be considered a surrogate marker of patients' volume status, was not significantly increased among those in the CKD

Table 3
Multivariable-adjusted odd ratios (OR, 95% CI) for AF associated with demographics and clinical risk factors for participants with and without CKD.

	Non-CKD		CKD	
	OR (95% CI)	P value	OR (95% CI)	P value
Demographics				
Age (years)	1.08 (1.07–1.10)	<0.001	1.08 (1.06–1.10)	<0.001
Male gender (yes/no)	0.59 (0.34–1.04)	0.068	1.10 (0.64–1.88)	0.738
Education level				
≤9 years	1.00 (Reference)		1.00 (Reference)	
>9 years	1.40 (0.94–2.09)	0.101	0.86 (0.47–1.57)	0.629
Clinical history (yes/no)				
Smoking	1.23 (1.07–1.57)	0.017	1.45 (1.27–1.72)	0.021
Alcohol intake	0.76 (0.53–1.10)	0.151	1.44 (0.91–2.28)	0.118
Hypertension	2.14 (1.44–3.17)	<0.001	1.09 (0.71–1.67)	0.704
Diabetes mellitus	1.79 (1.10–2.89)	0.019	0.82 (0.44–1.52)	0.523
Myocardial infarction	1.21 (0.97–1.47)	0.112	1.07 (0.67–1.70)	0.087
Congestive heart failure	1.35 (0.92–2.82)	0.131	1.41 (0.97–2.89)	0.091
Peripheral artery disease	1.05 (0.87–2.31)	0.324	1.22 (0.98–1.31)	0.251
Waist circumference (cm)	1.03 (1.01–1.04)	<0.001	1.03 (1.02–1.05)	<0.001
SBP (mm Hg)	0.99 (0.97–1.02)	0.821	0.99 (0.98–1.01)	0.355
DBP (mm Hg)	1.01 (0.99–1.03)	0.473	1.02 (1.00–1.04)	0.119
LDL cholesterol (mmol/L)	0.81 (0.45–1.13)	0.292	0.73 (0.38–1.40)	0.344
HDL cholesterol (mmol/L)	0.33 (0.061–1.81)	0.202	0.86 (0.29–2.53)	0.782
TG (mmol/L)	0.98 (0.85–1.14)	0.808	0.89 (0.74–1.06)	0.196
TC (mmol/L)	0.99 (0.81–1.20)	0.884	0.89 (0.58–1.38)	0.607
CRP (mg/L)	1.00 (0.98–1.02)	0.783	1.01 (1.00–1.03)	0.010
eGFR (ml/min/1.73 m^2)	0.98 (0.97–1.00)	0.008	0.97 (0.95–0.99)	0.006
Urine protein positive	–	–	2.01(1.09–3.74)	0.018

Adjusted for all covariates including age, sex, education level, clinical history, waist circumference, SBP, DBP, the serum level of LDL, HDL, TG, TC and CRP, eGFR and urine protein positive.

group. Inflammation has also been proposed to contribute to the higher prevalence of AF in the early stages of CKD, with studies demonstrating elevated levels of inflammatory markers in the early stage CKD and an association between inflammation and AF pathogenesis [27,28]. In this study, we found an association between elevated serum levels of the inflammatory marker CRP and an increased risk of AF. However, it is not clear whether other inflammatory markers other than serum CRP are also associated with AF, and this should be investigated in future studies. It is also worth noting that reduced eGFR and proteinuria, the two most important variables which determine CKD severity, were significantly associated with a higher prevalence of AF in the CKD population in our study. These associations support the finding that CKD is an important risk factor for AF, and future studies should seek to identify other potential risk factors for AF in the setting of CKD.

This study has some limitations worth noting. First, this is a cross-sectional study, and therefore, we are unable to establish causality between CKD and AF based on the present data. Second, our definition of AF was diagnosed based on ECG criteria, one resting ECG will inevitably miss some cases of paroxysmal AF during the study, this may have underestimated the true prevalence of all types of AF as we may have missed cases of paroxysmal AF. Third, the database used did not have information regarding albuminuria, and therefore, proteinuria was identified based on dipstick urine analysis. This may have affected our classification of different CKD stages, and potentially bring the bias in our multiple statistical analyses. Nevertheless, our study may be the largest community based sample yet to assess the different clinical epidemiological features of ECG-ascertained AF in CKD and non-CKD populations. The results obtained from these community dwelling-adults might have important implications for prevention of AF in Chinese adults with CKD.

5. Conclusions

Although the prevalence of AF in both CKD and non-CKD Chinese patients is lower than that in western populations, these two conditions require further investigation in the Chinese population. In this study, we found that the prevalence of AF in CKD is relatively higher than that in non-CKD, Importantly, some of the well-known risk factors for AF that were observed in the general population were not significantly related with AF in the setting of CKD. In particular, markers of kidney function and inflammation were associated with the prevalence of AF in CKD patients. This study elucidated the different features of AF in CKD and non-CKD populations and identified potential risk factors for better prediction of the risk of AF.

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Statement of ethics

This study was approved by the Tangshan Kailuan Hospital Ethical Review Board and informed consent was waived because unidentified information was used in the study.

Conflict of interests

All the authors declared no conflicting interests.

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