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The Potency of Serum Omentin-1 Quantification in Predicting Major Adverse Cardiac and Cerebrovascular Events Risk in Patients Receiving Hemodialysis

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Omentin-1 regulates inflammation, lipid accumulation, endothelial dysfunction, and atherosclerosis; the latter factors contribute to the occurrence of major adverse cardiac and cerebrovascular events (MACCE). This study aimed to explore the predictive implication of serum omentin-1 for MACCE risk in patients receiving hemodialysis. A total of 319 patients receiving hemodialysis and 160 healthy controls were prospectively enrolled in this study. Omentin-1 from serum was detected by enzyme-linked immunosorbent assay. MACCE was recorded during follow-up (median 18.9 months; range 1.9-62.9 months) in patients receiving hemodialysis. Omentin-1 was reduced in patients receiving hemodialysis versus healthy controls ($P < 0.001$). In patients receiving hemodialysis, omentin-1 was negatively related to C-reactive protein, total cholesterol, and low-density lipoprotein cholesterol (all $P < 0.05$); whereas omentin-1 was not related to other clinical characteristics. Notably, the 1-year, 2-year, 3-year, 4-year, and 5-year accumulating MACCE rates in patients receiving hemodialysis were 7.9%, 18.3%, 25.9%, 36.1%, and 41.4%, respectively. Interestingly, high omentin-1 related to decreased accumulating MACCE rate ($P = 0.003$), which was further validated by multivariate Cox regression analysis (hazard ratio = 0.458, $P = 0.006$). Additionally, by direct comparison, omentin-1 was reduced in hemodialysis patients who experienced MACCE compared to those who did not ($P < 0.001$); meanwhile, the receiver operator characteristic curve displayed that omentin-1 had an acceptable ability to estimate MACCE risk with an area under the curve (95% confidence interval) of 0.703 (0.628-0.777). Serum omentin-1 reflects reduced inflammation and lipid accumulation, as well as predicts decreased MACCE risk in patients receiving hemodialysis.

Keywords: hemodialysis; inflammation; lipid accumulation; major adverse cardiac and cerebrovascular event; omentin-1
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Introduction

Hemodialysis is a form of renal replacement therapy (RRT) that filters excess water and waste products out of patients' bodies (Himmelfarb and Ikizler 2010). Globally, it is estimated that hemodialysis is performed in nearly 89% of kidney failure patients, and its application assists in improving the survival of these patients to some extent (Himmelfarb et al. 2020; Thurlow et al. 2021; Ng et al. 2022). Unfortunately, major adverse cardiac and cerebrovascular events (MACCE) (including acute coronary syndrome, heart failure, cardiac death, and stroke) frequently occur in patients receiving hemodialysis, and the incidence of MACCE within 2 years in these patients ranges from 10.3% to 36.7% (Lee et al. 2014; Kim et al. 2015; Shimizu et al. 2019; Stirnadel-Farrant et al. 2019). Under this situation, exploring potential markers that predict MACCE might be meaningful to improve the management of patients receiving hemodialysis.

Omentin-1 is a novel adipocytokine, which has been found to regulate endothelial dysfunction, inflammation, atherosclerosis, and lipid accumulation; notably, the latter factors are responsible for the occurrence of MACCE (Jin et al. 2021; Lin et al. 2021; Zhao et al. 2022). For example, one previous study illustrates that omentin-1 inhibits endothelial injury by activating the amp-activated protein kinase/

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peroxisome proliferator-activated receptor δ pathway (Liu et al. 2020). Meanwhile, omentin-1 inhibits inflammation by suppressing the thioredoxin-interacting protein/NOD-like receptor 3 pathway in obese mice (Zhou et al. 2020). Moreover, omentin-1 regulates adenosine triphosphate-binding cassette transporter A1 (ABCA1) to inhibit lipid accumulation and atherogenesis (Tan et al. 2019). Clinically, some studies have reported the potential of omentin-1 as a predictor for death and carotid atherosclerosis in patients receiving hemodialysis (Kocijancic et al. 2015, 2016; Bolignano et al. 2022b). However, the correlation of omentin-1 with MACCE risk in patients receiving hemodialysis is not revealed by the above studies.

Accordingly, the current study aimed to explore the predictive implication of serum omentin-1 for MACCE risk in patients receiving hemodialysis.

Methods

Participants

From April 2017 to December 2021, three hundred and nineteen patients receiving chronic hemodialysis were enrolled in this prospective study. The inclusion criteria were: 1) received hemodialysis and current period for hemodialysis more than 1 year; 2) age ≥ 18 years old; 3) cooperated with serum sample collection; 4) could complete long-term follow-up assessed by researchers. The exclusion criteria were: 1) received peritoneal dialysis; 2) with uncontrolled arrhythmia; 3) with intracranial hemorrhage or intracranial hypertension; 4) multiple organ failure; 5) could not understand the study protocol. Besides, other 160 healthy people were enrolled as healthy controls (HCs), and their eligibility criteria were as follows: 1) age- and sex-matched to patients receiving hemodialysis; 2) had a healthy result in a physical examination; 3) understood the study protocol and cooperated with serum sample collection. The Ethics Committee approved this research. Each participant signed the informed consent.

Data and samples collection

Clinical characteristics of patients receiving hemodialysis were obtained, including demographics, chronic comorbidities, disease-related data, and laboratory test indexes. For all participants, the serum samples were gathered after enrollment and subsequently stored at −80°C. Then, the omentin-1 level was measured by enzyme-linked immunosorbent assay (ELISA) using commercial Human omentin-1 kits (No. Cat. ml037672, Shanghai Enzyme-linked Biotechnology Co., Ltd., Shanghai, China).

Follow-up and evaluation

All patients receiving hemodialysis underwent routine follow-ups until August 2022 (median follow-up time, 18.9 months; range, 1.9-62.9 months). MACCE was recorded, which contained acute coronary syndrome, heart failure, cardiac death, and stroke (Baek et al. 2017). Additionally, the accumulating MACCE rate was evaluated.

Statistics

Data analyses and figure construction were conducted via SPSS 24.0 (IBM Corp., Armonk, NY, USA) and GraphPad Prism 7.0 (GraphPad Software Inc., Boston, MA, USA), respectively. The Mann-Whitney U test was used for comparison analysis. Spearman test was applied for correlation analysis. In patients receiving hemodialysis only, the omentin-1 level was divided into high and low levels cut off by its median value, and further divided into first interquartile (Q1), second interquartile (Q2), third interquartile (Q3), and fourth interquartile (Q4) levels cut off by its interquartile values. The Kaplan-Meier (KM) curve was performed to show the accumulating MACCE rate, and Log-rank test was used. The ability of the omentin-1 level in distinguishing MACCE occurrence was performed by the receiver operator characteristic (ROC) curve. Univariable and forward-stepwise multivariable Cox proportional hazards regression analyses were used for finding the factors that were associated with MACCE, in which continuous variables were cut off by their median values. $P < 0.05$ indicated significance.

Results

Clinical features

The median (Q1-Q3) age of patients receiving hemodialysis was 60.0 (53.0-69.0) years. There were 132 (41.4%) females and 187 (58.6%) males. Meanwhile, 110 (34.5%) patients had cardiovascular and cerebrovascular diseases (CCVD), and the left 209 (65.5%) patients did not have that. Additionally, the median (Q1-Q3) hemodialysis duration was 52.0 (27.0-81.0) months (Table 1). Moreover, the median (Q1-Q3) value of the C-reactive protein (CRP) was 3.2 (2.0-5.4) mg/L. The median values of triglyceride (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) were 1.6 (0.9-2.4), 4.3 (3.7-5.1), 2.8 (2.2-3.4), and 1.1 (0.9-1.3) mmol/L, respectively. The detailed biochemical indexes of patients receiving hemodialysis is listed in Table 2.

Omentin-1 level

Omentin-1 was decreased in patients receiving hemodialysis [median (Q1-Q3): 207.0 (152.0-367.0) ng/mL] compared to HCs [median (Q1-Q3): 510 (403.8-733.5) ng/mL] ($P < 0.001$). The maximum and minimum values of omentin-1 in patients receiving hemodialysis were 802.0 and 65.0 ng/mL, and they were 1612.0 and 202.0 ng/mL in HCs (Fig. 1).

Relationship of omentin-1 with clinical characteristics

Omentin-1 was not related to age, sex, body mass index (BMI), hypertension, hyperlipidemia, diabetes, or CCVD in patients receiving hemodialysis (all $P > 0.05$) (Fig. 2A-G).

Omentin-1 showed no correlation with hemodialysis duration, clearance (K) multiplied by treatment time (t) and

Table 1. Clinical characteristics of hemodialysis patients.

Items	Hemodialysis patients (N = 319)
Age (years), median (Q1-Q3)	60.0 (53.0-69.0)
Sex, n (%)	
Female	132 (41.4)
Male	187 (58.6)
BMI (kg/m2), median (Q1-Q3)	21.3 (19.1-23.7)
Hypertension, n (%)	
No	83 (26.0)
Yes	236 (74.0)
Hyperlipidemia, n (%)	
No	195 (61.1)
Yes	124 (38.9)
Diabetes, n (%)	
No	242 (75.9)
Yes	77 (24.1)
CCVD, n (%)	
No	209 (65.5)
Yes	110 (34.5)
Hemodialysis duration (months), median (Q1-Q3)	52.0 (27.0-81.0)
Kt/V, median (Q1-Q3)	1.5 (1.2-1.7)

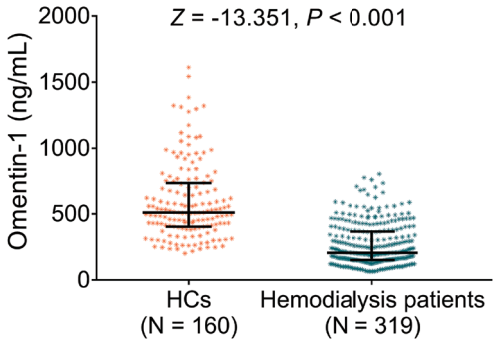
All continuous variables (including age) were in abnormality distribution and described as median (Q1-Q3). The Kolmogorov-Smirnov test was used.
BMI, body mass index; CCVD, cardiovascular and cerebrovascular diseases; Q1, the first interquartile; Q3, the third interquartile; Kt/V, calculated as clearance (K) multiplied by treatment time (t) and divided by the urea distribution volume (V).

Table 2. Biochemical indexes of hemodialysis patients.

Items	Hemodialysis patients (N = 319)
SBP (mmHg), median (Q1-Q3)	138.0 (126.0-151.0)
DBP (mmHg), median (Q1-Q3)	79.0 (72.0-85.0)
HB (g/L), median (Q1-Q3)	102.0 (89.0-113.0)
WBC ($\times 10^9$/L), median (Q1-Q3)	8.1 (6.6-9.5)
Platelet ($\times 10^9$/L), median (Q1-Q3)	203.0 (165.0-239.0)
ALB (g/L), median (Q1-Q3)	38.7 (34.8-43.2)
CRP (mg/L), median (Q1-Q3)	3.2 (2.0-5.4)
Ca (mmol/L), median (Q1-Q3)	2.2 (2.0-2.3)
P (mmol/L), median (Q1-Q3)	1.6 (1.3-1.9)
TG (mmol/L), median (Q1-Q3)	1.6 (0.9-2.4)
TC (mmol/L), median (Q1-Q3)	4.3 (3.7-5.1)
LDL-C (mmol/L), median (Q1-Q3)	2.8 (2.2-3.4)
HDL-C (mmol/L), median (Q1-Q3)	1.1 (0.9-1.3)

All continuous variables (including age) were in abnormality distribution and described as median (Q1-Q3). The Kolmogorov-Smirnov test was used.
SBP, systolic blood pressure; Q1, the first interquartile; Q3, the third interquartile; DBP, diastolic blood pressure; HB, hemoglobin; WBC, white blood cells; ALB, albumin; CRP, C-reactive protein; Ca, calcium; P, phosphorus; TG, triglyceride; TC, total cholesterol; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.

divided by the urea distribution volume (V) (Kt/V), systolic blood pressure (SBP), diastolic blood pressure (DBP), hemoglobin (HB), white blood cell (WBC), platelet, or albumin (ALB) (all $P > 0.05$) (Fig. 3A-H). Notably, omentin-1 was negatively associated with CRP ($P = 0.002$) (Fig. 3I). However, omentin-1 was not linked to calcium (Ca), phosphorus (P), or TG (all $P > 0.05$) (Fig. 3J-L). While omentin-1 was inversely correlated with TC ($P = 0.027$)



Omentin-1 (ng/mL)	HCs	Hemodialysis patients
Median	510.0	207.0
Q1	403.8	152.0
Q3	733.5	367.0
Min	202.0	65.0
Max	1612.0	802.0

Fig. 1. Comparison of omentin-1 between patients receiving hemodialysis and healthy controls (HCs).

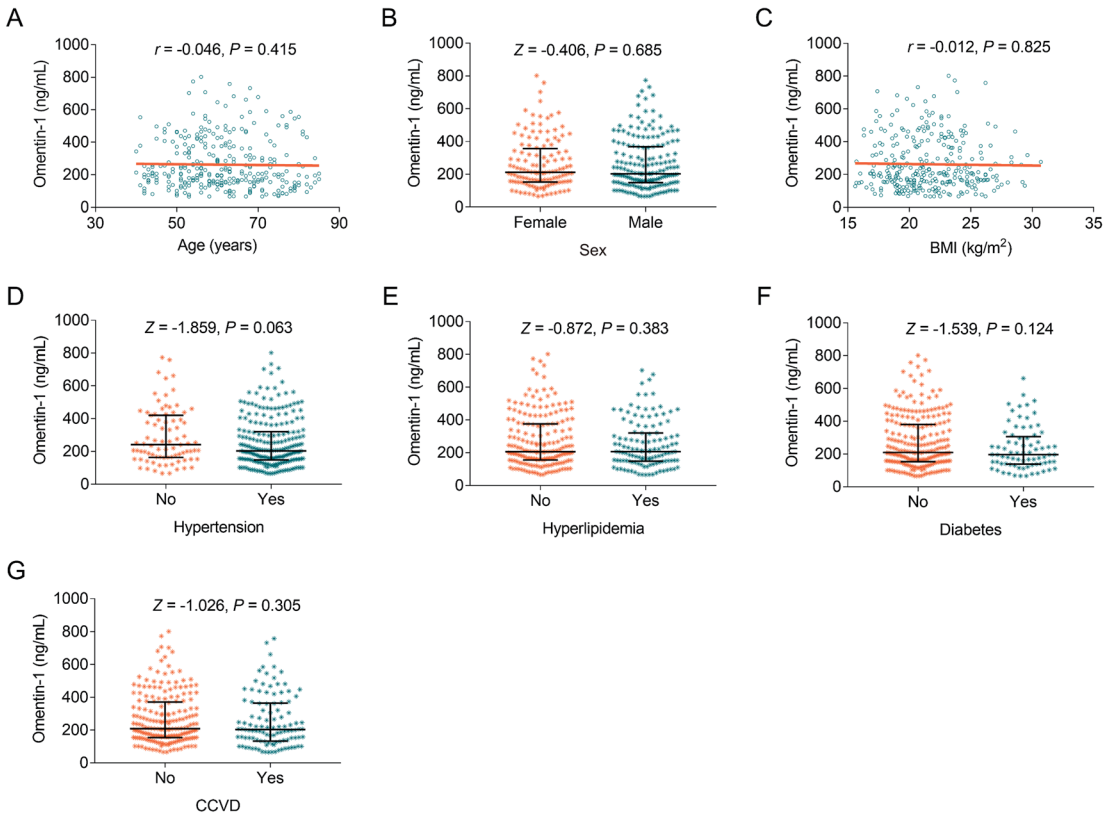


Fig. 2. Correlation of omentin-1 with demographical features and comorbidities in patients receiving hemodialysis. Relationship of omentin-1 with (A) age, (B) sex, (C) body mass index (BMI), (D) hypertension, (E) hyperlipidemia, (F) diabetes, and (G) cardiovascular and cerebrovascular diseases (CCVD) in patients receiving hemodialysis.

(Fig. 3M) and LDL-C (P = 0.012) (Fig. 3N), but not with HDL-C (P = 0.387) (Fig. 3O) in patients receiving hemodialysis.

Association of omentin-1 with accumulating MACCE rate

The accumulating MACCE rates were displayed in Fig. 4A, which revealed that the 1-year, 2-year, 3-year, 4-year, and 5-year accumulating MACCE rates were 7.9%, 18.3%, 25.9%, 36.1%, and 41.4%, respectively. The high level of omentin-1 was correlated with decreased accumulating MACCE rate in patients receiving hemodialysis (P = 0.003). The 1-year, 2-year, 3-year, 4-year, and 5-year MACCE rates were 5.6%, 11.8%, 18.9%, 23.4%, and 33.0% in patients with the high level of omentin-1, and they were 10.4%, 25.0%, 32.9%, 50.4%, and 50.4% in patients with the low level of omentin-1 (Fig. 4B). Moreover, accumulating MACCE rate was the highest in patients with the Q1 level of omentin-1, followed by patients with Q3 and Q2 levels of omentin-1, and the lowest in patients with Q4 level of omentin-1 (P < 0.001) (Fig. 4C).

Omentin-1 was reduced in patients who experienced MACCE [median (Q1-Q3): 153.0 (101.0-221.5) ng/mL] compared to those who did not [median (Q1-Q3): 220.0 (159.0-387.0) ng/mL] (P < 0.001) (Fig. 5A). In addition,

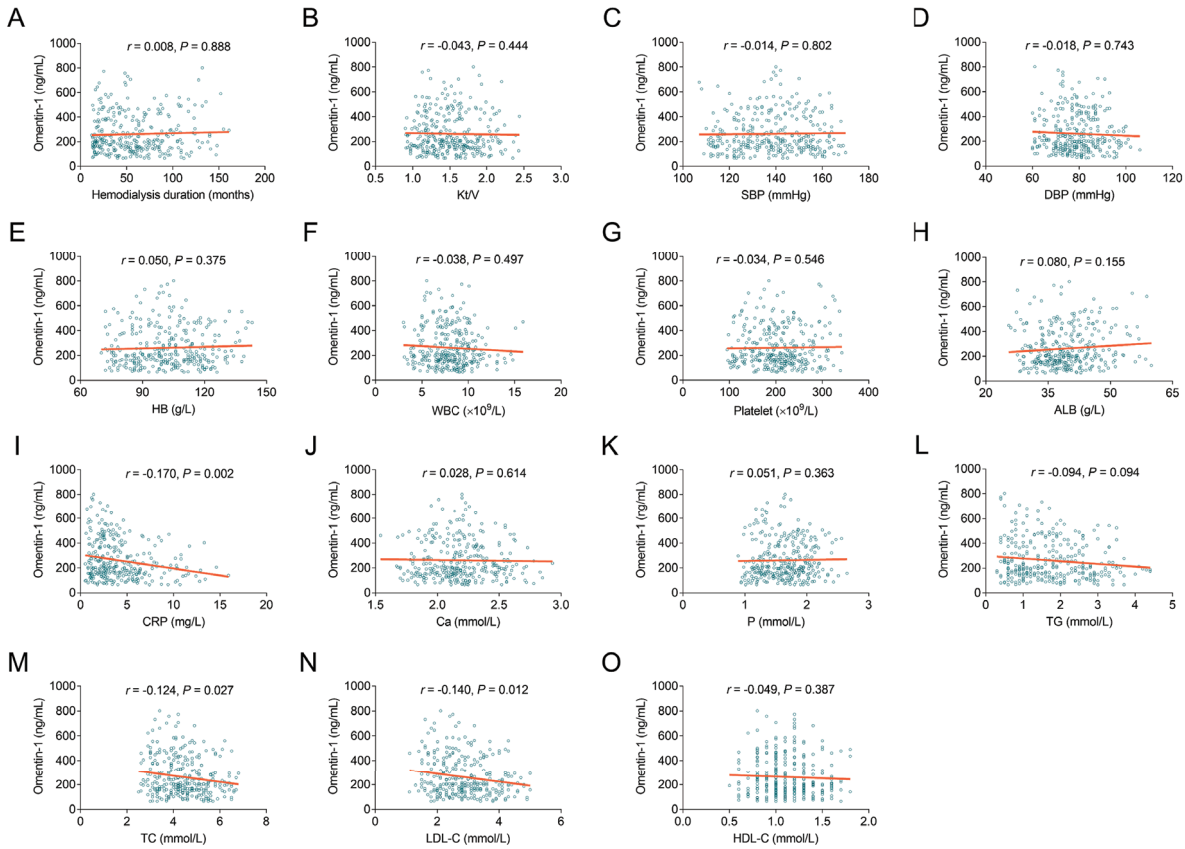
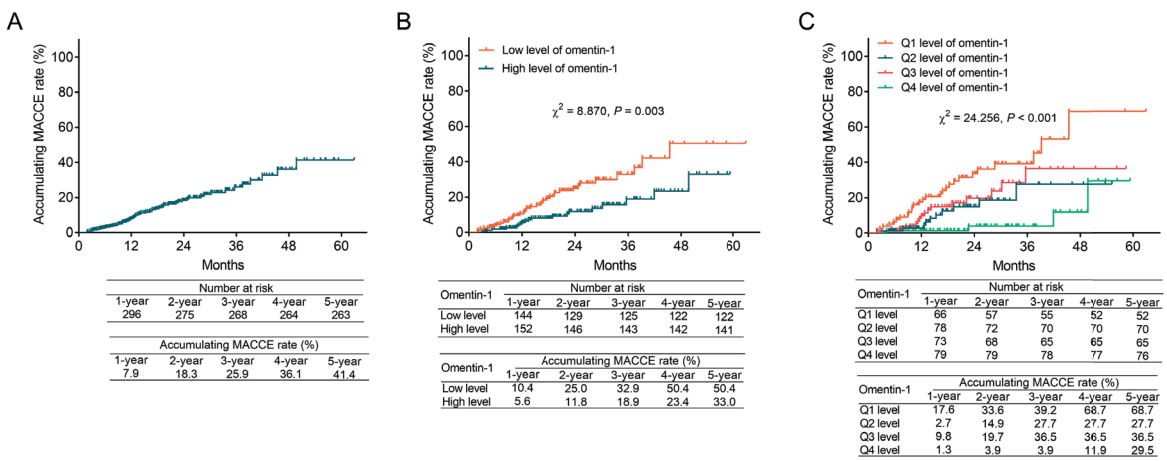


Fig. 3. Correlation of omentin-1 with disease features and biochemical indexes in patients receiving hemodialysis. Relationship of omentin-1 with (A) hemodialysis duration, (B) Kt/V, (C) systolic blood pressure (SBP), (D) diastolic blood pressure (DBP), (E) hemoglobin (HB), (F) white blood cell (WBC), (G) platelet, (H) albumin (ALB), (I) C-reactive protein (CRP), (J) calcium (Ca), (K) phosphorus (P), (L) triglyceride (TG), (M) total cholesterol (TC), (N) low-density lipoprotein cholesterol (LDL-C), and (O) high-density lipoprotein cholesterol (HLD-C) in patients receiving hemodialysis. Kt/V, calculated as clearance multiplied by treatment time (Kt) and divided by the urea distribution volume (V).



A

Number at risk				
1-year	2-year	3-year	4-year	5-year
296	275	268	264	263

Accumulating MACCE rate (%)				
1-year	2-year	3-year	4-year	5-year
7.9	18.3	25.9	36.1	41.4

B

Omentin-1	Number at risk				
	1-year	2-year	3-year	4-year	5-year
Low level	144	129	125	122	122
High level	152	146	143	142	141

Omentin-1	Accumulating MACCE rate (%)				
	1-year	2-year	3-year	4-year	5-year
Low level	10.4	25.0	32.9	50.4	50.4
High level	5.6	11.8	18.9	23.4	33.0

C

Omentin-1	Number at risk				
	1-year	2-year	3-year	4-year	5-year
Q1 level	66	57	55	52	52
Q2 level	78	72	70	70	70
Q3 level	73	68	65	65	65
Q4 level	79	79	78	77	76

Omentin-1	Accumulating MACCE rate (%)				
	1-year	2-year	3-year	4-year	5-year
Q1 level	17.6	33.6	39.2	68.7	68.7
Q2 level	2.7	14.9	27.7	27.7	27.7
Q3 level	9.8	19.7	36.5	36.5	36.5
Q4 level	1.3	3.9	3.9	11.9	29.5

Fig. 4. Predictive implication of omentin-1 for accumulating MACCE rate in patients receiving hemodialysis. (A) Accumulating MACCE rate presentation. (B) Correlation of omentin-1 (cut off by median values) with accumulating MACCE rate. (C) Association of omentin-1 (cut off by interquartile values) with accumulating MACCE rate.

omentin-1 had an acceptable ability to discriminate patients who experienced MACCE from those who did not with an area under the curve (AUC) [95% confidence interval (CI)] of 0.703 (0.628-0.777). Moreover, the value of omentin-1 at the best cutoff point was 167.5 ng/mL (sensitivity 70.7%; specificity 64.3%) (Fig. 5B). Furthermore, the combination

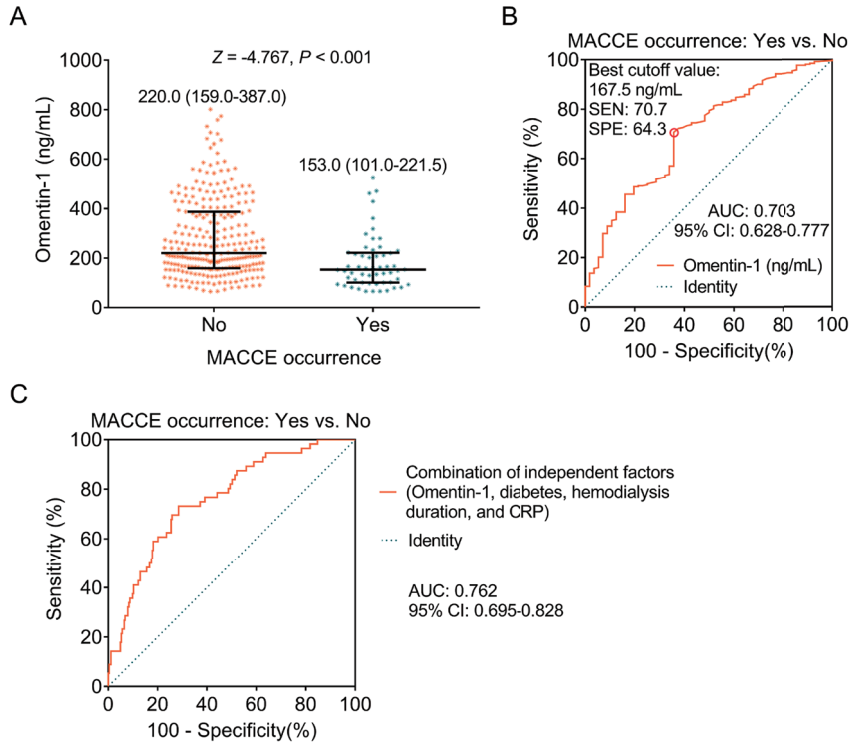


Fig. 5. Omentin-1 in patients receiving hemodialysis who experienced MACCE and those who did not. (A) Comparison of omentin-1 between patients receiving hemodialysis with MACCE and those without that. (B) The ability of omentin-1 for distinguishing patients who experienced MACCE from those who did not. (C) The capacity of the combination of independent factors (including omentin-1, diabetes, hemodialysis duration, and CRP) for distinguishing patients who experienced MACCE from those who did not.

of independent factors (including omentin-1, diabetes, hemodialysis duration, and CRP) had a certain ability to discriminate patients who experienced MACCE from those who did not with an AUC (95% CI) of 0.762 (0.695-0.828) (Fig. 5C).

Subgroup analysis of omentin-1 for MACCE

Omentin-1 was reduced in patients who experienced MACCE in 1 year ($P = 0.001$), 2 years ($P < 0.001$), 3 years ($P < 0.001$), 4 years ($P < 0.001$), and 5 years ($P < 0.001$) compared to those who did not. In addition, omentin-1 had an acceptable capacity to discriminate patients who experienced MACCE in 1 year [AUC (95% CI): 0.710 (0.604-0.817)], 2 years [AUC (95% CI): 0.715 (0.636-0.793)], 3 years [AUC (95% CI): 0.707 (0.634-0.781)], 4 years [AUC (95% CI): 0.714 (0.642-0.787)], and 5 years [AUC (95% CI): 0.703 (0.628-0.777)] from those who did not (Supplementary Table S1).

Independent factors for accumulating MACCE rate

Univariate regression analysis displayed that omentin-1 (high vs. low) [hazard ratio (HR) = 0.440, $P = 0.004$] was related to decreased accumulating MACCE rate. Additionally, age (high vs. low) (HR = 1.903, $P = 0.024$), diabetes (yes vs. no) (HR = 2.033, $P = 0.012$), CCVD (yes vs. no) (HR = 1.819, $P = 0.026$), hemodialysis duration (long vs. short) (HR = 1.822, $P = 0.034$), and CRP (high vs. low) (HR = 1.811, $P = 0.035$) were all associated with increased accumulating MACCE rate. Further multivariate regression analysis disclosed that omentin-1 (high vs. low) independently predicted reduced accumulating MACCE rate (HR = 0.458, $P = 0.006$); while diabetes (yes vs. no) (HR = 1.811, $P = 0.037$), hemodialysis duration (long vs. short) (HR = 1.823, $P = 0.036$), and CRP (high vs. low) (HR = 1.876, $P = 0.027$) independently estimated raised accumulating MACCE rate in patients receiving hemodialysis (Table 3).

Discussion

The dysregulation of omentin-1 in patients receiving hemodialysis has been revealed by several previous studies (Kocijancic et al. 2015; Bolignano et al. 2022a, b). One prior study finds out that omentin-1 has an abnormal level in patients receiving hemodialysis compared to HCs (Bolignano et al. 2022a). The present study discovered that omentin-1 was reduced in patients receiving hemodialysis versus HCs. A possible interpretation might be that decreased omentin-1 could induce renal injury by regulating microRNA-27a-nuclear factor erythroid 2-like 2 (miR-27a-Nrf2)/kelch like ECH associated protein 1 (Keap1) axis (Song et al. 2018). Thus, lower omentin-1 could reflect reduced renal function, and renal function was impaired in

Table 3. Cox proportional hazards regression analyses of accumulating MACCE rate.

Factors	*P* value	HR	95% CI	
			Lower	Upper
Univariate Cox proportional hazards regression analysis				
Omentin-1, high vs. low	0.004	0.440	0.253	0.767
Age, high vs. low	0.024	1.903	1.089	3.323
Sex, male vs. female	0.155	1.488	0.860	2.574
BMI, high vs. low	0.615	1.144	0.677	1.932
Hypertension, yes vs. no	0.119	1.724	0.870	3.417
Hyperlipidemia, yes vs. no	0.221	1.398	0.818	2.390
Diabetes, yes vs. no	0.012	2.033	1.171	3.530
CCVD, yes vs. no	0.026	1.819	1.074	3.082
Hemodialysis duration, long vs. short	0.034	1.822	1.048	3.169
Kt/V, high vs. low	0.337	1.300	0.761	2.221
SBP, high vs. low	0.126	1.533	0.887	2.649
DBP, high vs. low	0.331	1.300	0.766	2.207
Hemoglobin, high vs. low	0.313	0.763	0.451	1.291
WBC, high vs. low	0.763	1.084	0.641	1.832
Platelets, high vs. low	0.092	1.580	0.929	2.688
Albumin, high vs. low	0.067	0.603	0.351	1.036
CRP, high vs. low	0.035	1.811	1.041	3.150
Ca, high vs. low	0.534	1.183	0.696	2.014
P, high vs. low	0.489	1.204	0.711	2.037
Triglyceride, high vs. low	0.830	0.944	0.557	1.599
Total cholesterol, high vs. low	0.144	1.512	0.868	2.633
LDL-C, high vs. low	0.114	1.555	0.899	2.689
HDL-C, high vs. low	0.135	0.670	0.396	1.133
Forward stepwise-multivariate Cox proportional hazards regression analysis				
Omentin-1, high vs. low	0.006	0.458	0.262	0.800
Diabetes, yes vs. no	0.037	1.811	1.037	3.164
Hemodialysis duration, long vs. short	0.036	1.823	1.041	3.192
CRP, high vs. low	0.027	1.876	1.073	3.279

High and low levels of clinical factors were divided by each own median value.
MACCE, major adverse cardiac and cerebrovascular event; HR, hazard ratio; CI, confidence interval; BMI, body mass index; CCVD, cardiovascular and cerebrovascular diseases; Kt/V, calculated as clearance (K) multiplied by treatment time (t) and divided by the urea distribution volume (V); SBP, systolic blood pressure; DBP, diastolic blood pressure; WBC, white blood cell; CRP, C-reactive protein; Ca, calcium; P, phosphorus; LDL-C, low-density lipoprotein cholesterol; HDL-C, high-density lipoprotein cholesterol.

patients receiving hemodialysis (Kellum et al. 2021; Shaikhouni and Yessayan 2022). As a result, omentin-1 was lower in patients receiving hemodialysis versus HCs. Notably, the current study also discovered that the 95% CI of omentin-1 in HCs ranged from 481.5 to 557.0 ng/mL, which might provide a reference for the normal range of omentin-1 in healthy subjects. However, since the detection of omentin-1 was not a regular process in clinical practice, the finding of this study could not be generalized, and further validation was required.

The correlation of omentin-1 with clinical features in patients receiving hemodialysis is explored in several studies (Alcelik et al. 2012; Kocijancic et al. 2016; Bolignano et al. 2022b). For instance, one study discovers that omentin-1 is related to creatinine in end-stage renal disease patients receiving hemodialysis (Alcelik et al. 2012). This study further explored the correlation of omentin-1 with clinical features in patients receiving hemodialysis, and it turned out that omentin-1 was negatively linked to CRP, TC, and LDL-C in patients receiving hemodialysis. The possible explanations would be as follows: (1) Omentin-1 could inhibit inflammation in macrophages through the toll-like receptor 4/myeloid differentiation primary response 88/nuclear factor kappa B and phosphatidylinositol-3-kinase/protein kinase B pathways, etc. (Wang et al. 2020; Cabral et al. 2022). Thus, omentin-1 could reflect reduced CRP in

patients receiving hemodialysis. (2) Omentin-1 would suppress LDL-C to further reduce the accumulation of lipids by regulating ABCA1 (Tan et al. 2019). Hence, omentin-1 could also represent decreased LDL-C and TC in patients receiving hemodialysis. Taken together, omentin-1 involved in both inflammation and lipid accumulation. However, from the evidence of previous studies, it could not be figured out which one was a more direct mechanism regarding the regulating role of omentin-1 for inflammation and lipid accumulation, and further studies were required to solve this problem.

The predictive implication of omentin-1 for MACCE in patients receiving hemodialysis is still unclear. The current study applied multiple statistical methods, including the KM curve plus Log-rank test, Mann-Whitney U test, ROC curve analysis, and multivariate Cox regression analysis to further explore the association of omentin-1 with MACCE risk in patients receiving hemodialysis. It was found that omentin-1 predicted a lower accumulating MACCE rate in patients receiving hemodialysis, which was further confirmed by multivariate Cox regression analysis. Moreover, subgroup analysis discovered that omentin-1 was decreased in patients who experienced MACCE in 1 year, 2 years, 3 years, 4 years, and 5 years versus those who did not. These findings could be explained by that: Omentin-1 could reduce inflammation, lipid accumulation, endothelial injury, atherosclerosis, and cerebral ischemia-reperfusion injury to inhibit the occurrence of MACCE (Watanabe et al. 2016; Tan et al. 2019; Wang et al. 2020; Dong et al. 2021; Niu et al. 2021; Lin et al. 2021; Ma et al. 2022). As a result, omentin-1 reflected reduced MACCE risk in patients receiving hemodialysis.

This study revealed several interesting findings regarding omentin-1 in patients receiving hemodialysis. However, some limitations should be mentioned. Firstly, this was a single-center study, which would result in selection bias. Secondly, the longitudinal change of omentin-1 was not explored; thus, the implication of omentin-1 changes for monitoring the disease progression of patients receiving hemodialysis was unclear. Thirdly, although the longest follow-up duration was 62.9 months, the median duration was only 18.9 months, which indicated that the follow-up duration was not long enough in a proportion of patients; therefore, the long-term predictive implication of omentin-1 for MACCE risk in patients receiving hemodialysis still should be further validated. Fourthly, multiple-time detection of omentin-1 was not realized in this study; however, it might be meaningful to reflect the predictive implication of omentin-1 for MACCE in these patients.

To sum up, serum omentin-1 not only reflects reduced inflammation and lipid level but also exerts a potency to predict decreased MACCE risk in patients receiving hemodialysis. Considering that MACCE is a crucial issue in patients receiving hemodialysis, the findings of this study may help to better stratify these patients and improve their clinical outcomes.

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Conflict of Interest

The authors declare no conflict of interest.

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Supplementary Files

Please find supplementary file(s);
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