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Evaluating the Association between Frailty Status and Health Outcomes among Hospitalized Older adult Patients with Cardiovascular Disease: A Prospective Study

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ABSTRACT

Objective(s): This study aimed to assess frailty status and examine its association with in-hospital outcomes among patients admitted with acute cardiovascular conditions.

Methods: A prospective observational cohort study was conducted in the Cardiac Care Unit of Baquba Teaching Hospital in Diyala province from December 2024 to March 2025. Frailty was assessed by the validated tool Clinical Frailty Scale (CFS). In-hospital mortality, unscheduled 30-day readmission, and length of hospital stay were the primary outcomes measured.

Results: A total of 200 patients were recruited. The median age was 71 years, and (55.5%) of them were female. Of the cohort, 117 patients were considered frail, according to the CFS, giving a prevalence of (58.5%). Frailty was an independent predictor of in-hospital death, irrespective of adjusting some potential confounders (OR = 1.985, 95% CI = 1.218–3.235).

Conclusion: The study revealed that frailty was prevalent in elderly patients with cardiovascular disease. Frail patients had a higher rate of in-hospital mortality compared to their counterparts.

Recommendations: Based on the study result, it is vital to identify frailty status when assessing older adult patients to tailor cardiovascular treatment individually along with interventions to reduce frailty should be a primary focus in this high-risk population. Furthermore, frailty assessment could be adopted as risk stratification in the acute care setting.

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تقييم الارتباط بين وهن الشيخوخة و النتائج الصحية لدى المرضى كبار السن المصابين بأمراض القلب والأوعية الدموية الراقدين في المستشفى: دراسة مستقبلية

المستخلص

الأهداف: هدفت الدراسة إلى تقييم حالة الوهن واستكشاف ما إذا كان الوهن يرتبط بالنتائج داخل المستشفى لدى المرضى الذين تم إدخالهم بسبب حالات أمراض القلب والأوعية الدموية الحادة.

المنهجية: أجريت دراسة مراقبة مستقبلية في وحدة العناية القلبية بمستشفى بعقوبة التعليمي في محافظة ديالى للفترة من كانون الأول ٢٠٢٤ إلى آذار ٢٠٢٥. تم تقييم الوهن من خلال مقياس الوهن السريري (CFS) وهو مقياس معتمد. كانت الوفاة داخل المستشفى وإعادة الدخول غير المخطط له خلال ٣٠ يوماً من تاريخ المغادرة وطول مدة الإقامة في المستشفى هي النتائج الرئيسية التي تم قياسها.

النتائج: شملت الدراسة ٢٠٠ مريضاً، كان متوسط العمر ٧١ عاماً وكانت نسبة الإناث (٥٥.٥%). من بين المجموعة، اعتُبر ١١٧ مريضاً يعانون من الوهن وفقاً لـ CFS، بمعدل انتشار بلغ (٥٨,٥%). كان الوهن مؤشراً مستقلاً للوفاة داخل المستشفى بغض النظر عن تعديل بعض العوامل المربكة المحتملة (OR = 1.985, 95% CI = 1.218–3.235).

الاستنتاجات: كان الوهن شائعاً لدى كبار السن المصابين بأمراض القلب والأوعية الدموية. كان معدل الوفيات داخل المستشفى لدى المرضى الذين يعانون من الوهن أعلى مقارنةً بنظرائهم.

التوصيات: بناء على نتيجة الدراسة، يعد تحديد حالة الوهن عند كبار السن مهماً في تصميم علاج قلبي وعائي مُصمم خصيصاً لكل مريض، كما يجب ان يكون تقليل الوهن هدفاً رئيسياً لدى هذه الفئة عالية الخطورة. إضافة إلى ذلك، يمكن استخدام تقييم حالة الوهن كوسيلة لتحديد مستوى الخطر في حالات الرعاية الحادة.

الكلمات المفتاحية: أمراض القلب والأوعية الدموية، وهن الشيخوخة، النتائج الصحية، كبار السن

Introduction

Cardiovascular disease (CVD) is a common reason for hospitalization, particularly in the elderly. It correlates with high rates of morbidity and mortality, tremendous financial impact on healthcare systems, and poor quality of life ⁽¹⁾. Frailty is a geriatric syndrome marked by diminished physiological status, impaired homeostasis, reduced functional ability, enhanced vulnerability to stressors across multiple organ systems, and compromised tolerance to medical interventions leading to negative health outcomes among the older population ⁽²⁾. A robust bidirectional relationship between CVD and frailty has been documented, as both sharing similar pathophysiological basis with the activation of a chronic inflammatory process, reflected by an increase in inflammatory biomarkers playing the central role ⁽³⁾. In turn, this low-inflammatory state has direct or indirect effects at different levels, including the cardiovascular, musculoskeletal, immune, endocrine, and hematological systems, predisposing to frailty occurrences ⁽⁴⁾.

Importantly, frailty is a dynamic process, and with appropriate and timely intervention, its adverse outcomes can be avoided or mitigated, which means frailty is both preventable and reversible ⁽⁵⁾.

Evidence shows that even appropriate medicines can be harmful and present a situational challenge in frail older adults due to their numerous reserve deficits, that may affect their ability to cope with even a minor side-effect ⁽¹⁾; thus, frailty assessment plays a fundamental role in optimizing medication management, as it alters medication metabolism, elevates the chance of adverse drug reactions, and impacts overall treatment response ⁽⁶⁾. Moreover, incorporating frailty assessment in clinical practice is pivotal as it enables patient-centered care and supports informed decision-making regarding treatment strategies in hospitalized elderly ⁽⁴⁾.

Current guidelines regarding the management of heart disease have pointed out considering biological age of patients (the anticipated life

years remaining based on biological status), instead of birth date is essential when making clinical decisions among older adults, in this regard frailty status may be used as a valuable surrogate of their biological age ⁽⁴⁾.

In Iraq, evidence of frailty in the literature is rare and there is no previous study assessed frailty status in a hospital setting in Iraq. Therefore, the present study was designed to investigate frailty status among older inpatients and to explore its association with patient outcomes during hospitalization.

Methods

Study Design and Setting

A prospective observational cohort study was conducted at Baquba Teaching Hospital in Diyala province from December 2024 to day 31 of March 2025.

Study Sample and Sampling

The current study recruited 200 older patients hospitalized in the Cardiac Care Unit of Baquba Teaching Hospital in Diyala province. A convenience sampling technique was adopted to recruit study participants. Patients were included if they met the following inclusion criteria: Aged 65 years and older from both genders, admitted to the Cardiac Care Unit, previously diagnosed with CVDs, willing to participate in the study, with good cognitive function, and deemed clinically stable to be able to communicate with the researcher. Also, Patients' caregivers, who are familiar with their daily and medical needs were included in the study, and their presence was mandatory. While patients with terminal illnesses received palliative care, those who received acute care in the emergency department, and those discharged voluntarily against medical advice were excluded since these factors could affect the study outcomes measured.

Data Collection

An interview was conducted with each participant and/or their closest proxy. Each interview lasted approximately between 15-30 minutes. The study questionnaire was divided into three parts, encompassing different aspects: Part I includes socio-demographic

patients' data such as age, gender, educational level, monthly income, social status, and residence.

Part II includes clinical variables of the participants such as the type of cardiovascular diseases, comorbid conditions, and hospital admissions during the past year, these information's were obtained during the interview and confirmed from the patient's medical file.

Polypharmacy was verified by the first author by counting the number of chronic medications used by each older patient and accordingly classified into the following groups: No polypharmacy: less than five drugs, polypharmacy: Between 5-9 drugs, and hyperpolypharmacy: More than 10 drugs ⁽¹⁰⁾. The Charlson Comorbidity Index (CCI) was used to quantitatively assess the burden of chronic disease in each patient, which combines both disease severity and numbers into a comorbidity-weighted index ⁽¹¹⁾.

Part III involves assessment of frailty status by the Clinical Frailty Scale, a non-invasive screening tool entails nine points ranging from 1 (very fit) to 9 (terminally ill). To assist the classification process, each point on this scale has pictographs with a written description of frailty ⁽¹²⁾. This tool has been well-validated as an indicator of adverse outcomes for hospitalized older patients; its use is relatively easy, not time-consuming to implement in daily clinical practice, and without the need for additional tests, equipment, specific geriatric expertise, or functional testing. After a brief assessment, each patient was assigned a CFS score, then the patients were allocated into two groups: Non-frail (score 1-4) and frail (score \geq 5).

Outcomes Measured

Each patient was followed from admission until discharge. In-hospital mortality was documented for patients who died during this index hospitalization, length of hospital stay was calculated as the number of consecutive days between the time of admission and discharge (or death), while 30-day readmission was determined if the patient was reencountered in the Cardiac Care Unit 30 days following discharge from the current admission, otherwise by telephone interviews

with the patient and/or caregiver, to exclude admission to another facility. Additionally, the cost of medications prescribed was captured from the pharmacy units and tracked for each patient. The cost was defined as the medication cost of treating CVDs and any related complications delivered by the hospital during the hospitalization period.

Ethical Considerations

The study was approved by ethical committee of the College of Pharmacy, University of Baghdad (approval no. REC06٢٠٢٥١٠R on November 26, 2024). Also, the Ministry of Health approved the study (approval no.50303 on December, 12 2024). The patient and their close relatives gave verbal informed consent to participate after explaining the study objectives. Confidentiality of participants was ensured throughout the

study, and no incentives were offered to the participants.

Data Analysis

Statistical Package for Social Sciences (SPSS version 27, IBM), was utilized for analysis of data. The continuous variables were confirmed to have skewed distributions through the Shapiro–Wilk test; accordingly, were presented as the median, interquartile range (IQR), and compared using the Mann–Whitney test, whereas categorical variables were summarized as counts (percentages) and compared by using the Chi-square test.

To identify factors independently associated with dichotomous outcomes, a multivariate logistic regression was constructed, adjusting for relevant confounders. The results were presented as adjusted odds ratios (AOR) with corresponding 95% confidence intervals (95% CI). A p-value less than 0.05 was deemed statistically significant.

Results

Table 1. Socio-Demographic and Clinical Characteristics of the Participants by their Frailty Groups

Parameters	Categories	Total n=200	Non frail	Frail	P-value
Age groups (years), F (%)	65-74	154 (77)	69 (44.8)	85 (55.2)	0.091
	≥75	46 (23)	14 (30.4)	32 (69.6)	
Age (years), median (IQR) 71(68-74)					
Gender, F (%)	Male	89 (44.5)	48 (53.9)	41(46.1)	0.002*
	Female	111(55.5)	35 (31.5)	76 (68.5)	
Educational level, F (%)	Illiterate	26 (13)	11 (42.3)	15 (57.7)	0.389
	Primary	46 (23)	21(45.7)	25(54.3)	
	Secondary	67 (33.5)	25 (37.3)	42 (62.7)	
College and higher	College and higher	61 (30.5)	26 (42.6)	35 (57.4)	0.841
	Single	19 (9.5)	7(36.8)	12(63.2)	
	Married	116 (58)	53 (45.7)	63 (54.3)	
Social state, F (%)	Widowed	65(32.5)	23 (35.4)	42 (64.6)	0.881
	Rural	69 (34.5)	28 (40.6)	41 (59.4)	
Residence, F (%)	Urban	131(65.5)	55 (42)	76 (58)	0.308
	Less than 500,000 IQD	63 (31.5)	23(36.5)	40(63.5)	
Monthly income, F (%)	500,000-1 million IQD	113 (56.5)	52(46)	61(54)	<0.001*
	More than 1 million IQD	24 (12)	8 (33.3)	16 (66.7)	
CFS score, median (IQR)	--	5 (4-6)	4 (3-4)	6 (5-7)	0.026*
Number of diseases, F (%)	1-2	73 (36.5)	38(52)	35 (48)	<0.001*
	3 or more	127(63.5)	45 (35.4)	82 (64.6)	
CCI score, median (IQR)	--	1(1-2)	1(1-2)	2(1-3)	0.013*
Hospitalization in previous year, F (%)	No	119 (59.5)	58 (48.7)	61(51.3)	0.013*
	Yes	81 (40.5)	25 (30.9)	56 (69.1)	

Number of medications, F (%)	Less than five	21(10.5)	13 (62)	8 (38)	<0.001*
	5-9	134 (67)	64 (47.8)	70 (52.2)	
	More than 10	45 (22.5)	6 (13.3)	39 (86.7)	

* Asterisks denote significant association at p-value <0.05.

Comparison was done using Chi-square or Mann-Whitney test.

F: Frequency, **%:** Percentage, **CFS:** Clinical Frailty Scale, **CCI:** Charlson Comorbidity Index, **IQR:** Interquartile range, **IQD:** Iraqi dinar.

Table 1 highlighted that a total of 200 inpatients were enrolled in the study. Of whom 111(55.5%) were female, with a median age (IQR) of 71 years (68-74). More than half of the patients (58%) were married, and the majority had low to medium income. Stratification of baseline socio-demographic and clinical characteristics of the recruited individuals according to their frailty categories shows that frail patients tend to be female, with high comorbidity index, have significantly higher CFS scores, consume multiple medications, and underwent more hospitalizations in the previous year. While non-significant differences were found across the frailty groups with regard to age, educational background, marital status, monthly income, and residence.

Table 2. Cardiovascular and Comorbid Conditions Identified in the Study Participants

Variable	Categories	Frequency	Percent (%)
Type of cardiovascular disease	Ischemic heart disease	119	59.5
	Heart failure	78	39
	Arterial hypertension	103	51.5
	Atrial fibrillation	47	23.5
	Supraventricular tachycardia	13	6.5
	Cerebrovascular accident	21	10.5
	Valvular heart disease	7	3.5
Type of comorbidities	Diabetes mellitus	89	44.5
	Chronic kidney disease	14	7
	Chronic obstructive pulmonary disease	8	4
	Asthma	16	8
	Gout	2	1
	Hyperthyroidism	8	4
	Rheumatoid arthritis	1	0.5
	Benign prostatic hyperplasia	7	3.5
	Peptic ulcer	5	2.5
	Hypothyroidism	4	2
	Epilepsy	1	0.5

Table 2 illustrated that ischemic heart disease, arterial hypertension, heart failure, and atrial fibrillation were the most prevalent CVDs, while diabetes mellitus was the most dominant comorbid condition.

Table 3. Frequency Distribution of Clinical Frailty Scale Scores and Description

Score	Description	Frequency	Percent (%)
1	Very fit	---	---
2	Fit	6	3
3	Managing well	23	11.5
4	Living with Very mild frailty	54	27
5	Living with Mild frailty	44	22

6	Living with Moderate frailty	43	21.5
7	Living with Severe frailty	28	14
8	Living with Very severe frailty	2	1
9	Terminally ill	---	---

Table 3 showed that according to CFS score, 83 (41.5%) patients were categorized as non-frail, whereas 117 individuals (58.5%) of the cohort were considered frail. The assigned CFS scores ranged from 2 (fit) to 8 (very severely frail); none of the patients met the criteria for the ‘very fit’ and ‘terminally ill’ categories.

Table 4. Outcomes of Patients by Frailty Groups

Outcomes	Total	Non frail	Frail	P-value
In-hospital mortality, F (%)	21(10.5)	4 (4.82)	17(14.53)	0.034**
30-day unplanned readmission, F (%)*	27(15.1)	8(10.13)	19 (19)	0.14
Length of stay, days, median (IQR)	5(4-6)	4(3-5)	5(4-6)	0.011**
Medication cost, IQD, median (IQR)	70164 (47791.82-93998.89)	65789.32 (44573.82-88943)	74131.28 (49604.19-96910.07)	0.226

Comparison was done using Chi-square or Mann-Whitney test.

*After excluding deceased patients, n= (179), ** Significant at p-value <0.05.

F: Frequency, %: Percentage, IQD: Iraqi dinar, IQR: Interquartile range.

Table 4 demonstrated that when comparing hospital outcomes of the studied cohort, there was a statistically significant difference in death during hospitalization (17 versus 4, p-value=0.034) and length of stay between frail and non-frail patients, whilst unplanned 30-day readmission and medications costs were not different across frailty groups.

Table 5. Predictors of Mortality among the Study Cohort

Variables	AOR	95%CI	P-value
Age (years)	1.047	0.914-1.200	0.508
Gender (female)	0.721	0.248-2.099	0.549
Clinical Frailty Scale score	1.985	1.218-3.235	0.006
Charlson Comorbidity Index score	1.582	0.972-2.575	0.065
Number of morbidities	1.292	0.687-2.433	0.427

AOR: Adjusted odds ratio, CI: Confidence interval.

Table 5 indicated that after controlling for age, gender, Charlson Comorbidity Index, and number of chronic morbidities, frailty was independently and strongly associated with in-hospital death, as shown by multiple binary logistic regression analysis.

Discussion

The current study revealed that over half of older inpatients screened by CFS were classified as frail. This prevalence was lower than what has been reported by a study carried out by Alamri et al. in Saudi Arabia (17), while higher than the prevalence observed by Saad et al. in an academic hospital (14). Such discrepancies could be

attributed to variation in the socio-demographic characteristics of the population studied, study setting, sample size, the presence of chronic diseases, and the various assessment tools employed. Age did not vary significantly between frailty categories; this finding contrasts with previous study reported that frailty is associated with advanced age (15), but was congruent with another study (17), this

differences may stem from inconsistency in sample size or the reality that advanced age itself increases the probability of frailty; however, those who were getting old are not necessarily getting frail, as some patients remain vigorous despite advanced age, thus, it is not an inevitable progression of aging and across the population aging process is not homogenous owing to variations in lifestyle, genetic predisposition, and overall health ⁽¹³⁾. Frailty was more prevalent in female participants, this finding was in agreement with other study ⁽¹⁴⁾ and be attributed to the hypothesis that females live longer than males. Moreover, hormonal, epigenetic, social, physiological, and psychological factors have been proposed as an implicated reasons for making older females frailer than males ⁽¹⁵⁾. In the current study, no statistical difference was observed among frailty groups with respect to educational level, this finding contrasts with the study by Soler-Vila et al. who reported an association between frailty and lower educational level by affecting the health literacy of an individual ⁽¹⁹⁾. Similarly, being unmarried was not significantly associated with frailty in the present study, whereas previous study found that lack of social support increases the risk of social frailty ⁽²⁰⁾. In addition, no meaningful difference was reported in terms of area of residence. This finding does not align with previous study indicated that those living in rural area have a low probability of frailty, possibly due to higher physical activity among this population ⁽²¹⁾. Moreover, no difference was observed in relation to income level. This finding contrasts with previous research reported that older people with low income have a high likelihood of frailty, explained by poor nutrition and limited access to health care resources ⁽²²⁾. These non-significant associations in the present study may be related to variations in population characteristics and sample size. Frail patients experienced more hospitalizations in the previous year, corroborating the results of other studies including a meta-analysis of eight studies that found a higher risk of hospitalization among frail older adults ⁽²³⁾. Evidence has

shown that there is strong relationship between frailty and multi-morbidity, and those with chronic multi-morbidity are more vulnerable to experience frailty than the general elderly, as geriatric comorbidities causes decline in multiple physiological systems; ultimately leading to disturbances in homeostatic imbalance ⁽²⁴⁾.

Polypharmacy was highly prevalent among the studied cohort and justified by the presence of multi-morbidity necessitating the prescription of multiple medications. The prevalence in this study was more than the percentage reported by a prior study conducted in Baghdad ⁽²⁵⁾. Similar to previous studies, our findings found that there is a meaningful correlation between frailty and polypharmacy. A previous study conducted by Alqahtani et al. suggested a potential bidirectional causal relationship between higher medication count and frailty, with a cutoff value of five or more medications discriminate between frail and non-frail with good sensitivity and specificity ⁽²⁶⁾.

The use of medication is a prominent consideration when tackling the complex care requirements of the frail population; as a result, optimizing medications is paramount since frailty adds additional complexity to the management of the older population, making them more susceptible to potentially inappropriate prescribing and further tipping the risk-benefit ratio of medication use in this population. A previous study carried out in Iraq reported that potentially inappropriate prescribing was highly prevalent among geriatric patients ⁽²⁷⁾.

It is noteworthy to mention that frail older people may have discrepancies in their medications, exacerbated by multiple prescribers, reduced ability to recall medications, frequent transitions of care, complex regimens, and potential confusion with generic and brand names ⁽²⁸⁾. As a result, a structured medication review along with de-prescribing superfluous or inappropriate drugs and medication reconciliation to keep an updated medication

list are crucially recommended for the care of older frail patients ⁽²⁹⁾.

In this regard, pharmacists play an important role in optimizing medication across hospital wards, acute care settings, and community pharmacies, which results in a reduction of drug-related problems (DRPs), the number of medications being prescribed, and improved patient adherence ^(30,31). A previous interventional study conducted in Baghdad found that Pharmacists can have a prominent role in identifying and minimizing DRPs in cardiology wards with their interventions were endorsed ⁽³²⁾, another study by Jabri et al. reported that pharmacist intersection had a remarkable good influence on the prescribing practices of cardiologists, which could enhance patient outcomes ⁽³³⁾.

The current study revealed that frailty was correlated with an elevated odds of in-hospital mortality and prolonged hospital stay. The risk of death remained statistically significant regardless of adjusting for some potential confounders. These findings are parallel to those reported in previous studies, embracing a large meta-analysis ⁽³⁴⁾. The independent impact of frailty on death is explained by diminished resilience to cope with stressful events. Moreover, the reduction in physiological reserve and accompanying debilitation of body function, leading to a slow recovery process and prolonged hospital stays.

The non-significant risk for readmission could potentially be attributed to the short follow-up duration and the high mortality rate during this index hospitalization among frail patients.

While a previous study has demonstrated that frailty was linked with an increased consumption of healthcare resources and collectively higher hospital costs during an inpatient admission ⁽³⁵⁾, the current study did not found cost differences, this could be attributed to the inclusion of patients with various CVD types, diverse treatment modalities, medication classes, and different hospitalization periods. Nevertheless, CVD treatments have a significant burden on healthcare resources, as confirmed by a recent study performed by Mahdi et al.

estimating the cost of illness of acute coronary syndrome in public Iraqi hospitals ⁽³⁶⁾.

Limitations

This study has some limitations that must be addressed. The study included hospitalized patients recruited from a single hospital, which limits the generalizability of results, the relatively small sample size was due to exclusion of many patients with unstable clinical conditions, participants were heterogeneous in CVD type and treatment regimens, and the potential of residual confounding when comparing outcomes between non-frail and frail patients cannot be ruled out.

Conclusion

Among patients with CVD, frailty was prevalent and correlated with worse health outcomes. Frail patients had a higher rate of in-hospital mortality and tend to stay longer in the hospital compared to their counterparts.

Recommendations

Given its potential reversibility, it is vital to identify frailty status when assessing older adult patients to tailor cardiovascular treatment individually along with interventions to reduce frailty should be a primary focus in this high-risk population. Furthermore, frailty assessment could be adopted as risk stratification in the acute care setting.

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Conflict of interest:

None

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None.

Data availability statement

The data that support the findings of this study are available from the authors, but restrictions apply to the availability of these data, which were used under license for the current study and are not publicly available. However, the data can be obtained from the authors upon reasonable request and with appropriate permissions.

Author contribution

NMK designed, conducted, and analyzed the study, and drafted the manuscript. JMY supervised the research and provided critical review.

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