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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Arterial hypertension among retired elderly in a geriatric clinic in Querétaro, Mexico

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Abstract

Background: *The world's aging population, as projected by the World Health Organization (2017) to increase by 12-22% of older adults by 2050, presents new health challenges, notably the rise in chronic-degenerative diseases, particularly high blood pressure (HTN).* **Objective:** *This study aims to analyze the prevalence of HTN, associated risk factors, and their relationship with variables in the epidemiological profile of elderly individuals.* **Material and methods:** *This is an observational/retrospective study using a database of the medical profile of 213 older retired adults between January 2022 and March 2023. A total of 43 variables were analyzed. Associations were evaluated using the X^2 statistical test, and relationships were examined using the Mann–Whitney U test. Multiple logistic regressions were employed to analyze predictor variables for HTN.* **Results:** *The prevalence of arterial hypertension was 47.9%. Normal body mass index was identified as a protective factor in 59% of cases, while diabetes, polypharmacy, hypothyroidism, and overweight were recognized as risk factors (95% CI). Diabetes (odds ratio [OR] = 4.19) and polypharmacy (OR = 2.56) predicted HTN. A correlation was noted between a higher number of medical consultations and hypertension, with a mean of 7.22 versus 5.48.* **Conclusion:** *Among older adults, there is a high prevalence of HTN, with diabetes and polypharmacy identified as risk factors.*

Keywords: *Aging. Arterial hypertension. Health profile. Retirement. Geriatrics.*

Hipertensión arterial en el adulto mayor jubilado en una clínica geriátrica en el estado de Querétaro, México

Resumen

Antecedentes: *Acorde con la OMS (2017), la población mundial se encuentra envejeciendo, proyectando un aumento del 12% al 22% de adultos mayores para el año 2050. Planteando nuevos desafíos en salud, destacando el incremento de enfermedades crónico-degenerativas, en particular de hipertensión arterial.* **Objetivo:** *El estudio busca analizar la prevalencia de hipertensión arterial, factores de riesgo, relación y asociación con variables en el perfil epidemiológico del adulto mayor.* **Material y métodos:** *Estudio observacional/retrospectivo utilizando una base de datos del perfil médico de 213 adultos mayores jubilados entre enero de 2022 y marzo de 2023. Se analizaron 43 variables. La asociación se evaluó con la prueba estadística chi cuadrada y la relación con U Mann-Whitney. Se empleó una regresión logística múltiple para analizar las variables predictoras de hipertensión arterial.* **Resultados:** *47.9% de prevalencia de hipertensión arterial. IMC normal se identifica como factor protector en un 59%; diabetes, polifarmacia, hipotiroidismo y sobrepeso se muestran como factores de riesgo (IC 95%). Diabetes (OR = 4.19) y polifarmacia (OR = 2.56) predicen hipertensión arterial. Relación entre más consultas médicas e hipertensión media 7.22 contra. 5.48.* **Conclusión:** *Existe alta prevalencia de hipertensión arterial entre adultos mayores, siendo diabetes y polifarmacia factores de riesgo.*

Palabras clave: *Envejecimiento. Hipertensión arterial. Perfil de salud. Jubilación. Geriatría.*

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INTRODUCTION

In Mexico, one of the primary health concerns is the high prevalence of high blood pressure (HTN) among older adults, as indicated by the Medio Camino National Health and Nutrition Survey (ENSANUT MC 2020)[1], which is based on the classification of the Seventh Joint National Committee-7. It indicates that 30.2% of Mexican adults suffer from hypertension. Alarmingly, only half of those diagnosed by a doctor have their values under control. Vascular resistance increases with age due to the loss of flexibility of the vascular wall and lower cardiac output associated with aging, thus elevating the risk of HTN in older adults.

The results of ENSANUT 2020[2] reveal a higher prevalence of HTN with advancing age, being 143% higher in adults over 60 years of age compared to young adults aged 20-29 years. This finding is consistent with a 2015 meta-analysis[3], which included adults from 45 countries and demonstrated that the prevalence of HTN is higher in individuals over 65 years of age (65.6%) compared to younger adults (28.7%).

The World Health Organization (WHO)[4] considers hypertension a significant public health problem, responsible for at least 45% of deaths from heart disease and 51% from cerebrovascular disease. In Mexico, it has maintained its position among the top nine causes of death for the past two decades, with the mortality rate increasing by 29.9% in the past six years. In 2015, hypertension accounted for 18.1% of total deaths and was identified as the main risk factor for preventable deaths[5].

Lifestyle modification is presented as the best approach to preventing, treating, and controlling HTN. However, the Mexican older adult population predominantly exhibits a sedentary lifestyle, with 58.3% of them falling into this category[5]. According to the body mass index (BMI) ranges published in 2022 by the National Center for the Prevention of Chronic Diseases and Health Promotion[6], epidemiological data show that 39.1% of the adult population is overweight and 36.1% is obese[7]. These findings support the need to implement preventive and comprehensive clinical management actions, especially considering the 50% increase in health resource consumption by older individuals and the doubling of the probability of hospitalization[8].

Study design

This is a cross-sectional study that adheres to the standard communication guidelines for observational studies in epidemiology[9]. The research was conducted at a specialized geriatric clinic situated in the state of Querétaro.

Sample size

The sample selection employed convenience sampling, drawn from the total population of retired older adults attending the specialized geriatric clinic, totaling 213 patients. Therefore, no specific formula was utilized to determine the sample size.

MATERIAL AND METHODS

Data collection occurred using a database tailored specifically for this study during February, March and April 2023. A total of 43 variables were considered, categorized into sociodemographic (sex, employment status, social stratification, and educational level), anthropometric (age, weight, height, and BMI), clinical (acute diseases, coronavirus disease-19, chronic/degenerative diseases, and allergies), and a section focusing on mental health within the clinic, assessing the presence of mental disorders among older adults and whether they received treatment. In addition, the geriatric clinic service section encompassed the number of consultations, specialists consulted, hospitalizations, emergency room visits, surgeries performed, most common surgeries among retired older adults during the study period, and prescribed medications, including an evaluation of polypharmacy.

Data extracted from the medical records of the 213 patients were entered into a database using IBM Statistical Package for the Social Sciences version 25 statistical software. To assess variables related to arterial hypertension (HTN), specific statistical tests were employed. The X^2 test was utilized for categorical variables, with a statistical significance level of 0.05 (95% confidence interval [CI]), while parametric tests and the Mann–Whitney U statistical test were applied to numerical variables to analyze their relationships, also with a statistical significance level of 0.05 (95% CI). Furthermore, a multiple logistic regression model was developed to analyze potential predictor variables of HTN within the studied population.

RESULTS

The analysis of the elderly profile, with a focus on the variable of HTN, reveals that this disorder affects 47.9% of the studied population. Notably, females comprise 62.6% of the population, and mental disorders are prevalent in 44.1% of this group. In addition, it was identified that 47.3% of the population are overweight based on their BMI, while 74.4% are classified as sedentary. The most consumed medication was telmisartan, used by 17.1% of the population.

Table 1. Baseline characteristics of older adults treated in a geriatric clinic in Querétaro, Mexico, 2023

Characteristic	n (%)
Sex - no, n (%)	
Women	132 (62.6)
Men	79 (37.4)
BMI - no, n (%)	
Malnutrition	3 (1.4)
Normal weight	71 (34.3)
Overweight	98 (47.3)
Obesity	22 (10.6)
Morbid obesity	13 (6.3)
Morbidity - no, n (%)	
Arterial hypertension	101 (47.9)
Mental health illnesses	93 (44.1)
Orthopedic diseases	69 (32.7)
Diabetes mellitus	60 (28.4)
Gastrointestinal diseases	52 (24.6)
Coronavirus disease-19	49 (23.2)
Heart disease	37 (17.5)
Hypothyroidism	36 (17.1)
Cancer	28 (13.3)
Osteoporosis	28 (13.3)
Neurodegenerative diseases	20 (9.5)
Renal insufficiency	10 (4.7)
Others	120 (56.9)
Polypharmacy (> 3 medications/day) - no, n (%)	
Yes	8 (3.8)
No	8 (3.8)
Physical activity - no, n (%)	
Hike	35 (16.6)
Zumba	4 (1.9)
Yoga	3 (1.4)
Swimming	1 (0.5)
Gym	1 (0.5)
Others	7 (3.3)
Age-years*	73.14 ± 8.76
Weight-kilograms*	71.16 ± 16.54
Height-meters*	1.59 ± 0.08
Consultations per year - frequency*	6.43 ± 5.27

*The plus-minus values represent the mean and its standard deviation. no: number; %: percentage.

Table 2. Factors associated with the presence of arterial hypertension in older adults treated in a geriatric clinic in Querétaro, Mexico, 2023

Factor	Arterial hypertension		OR (95% CI)
	Yes	No	
Normal weight			
Yes	24	47	0.41 (0.22-0.75)
No	75	61	1
Overweight			
Yes	55	43	1.89 (1.08-3.28)
No	44	65	1
Diabetes mellitus			
Yes	44	16	4.53 (2.34-8.77)
No	57	94	1
Hypothyroidism			
Yes	25	11	2.96 (1.37-6.39)
No	76	99	1
Polypharmacy			
Yes	53	27	3.39 (1.89-6.08)
No	48	83	1

OR: odds ratio; CI: confidence interval.

Table 3. Bivariate analysis between arterial hypertension and selected variables in older adults treated at a geriatric clinic in Querétaro, Mexico, 2023

Variables	Score	gl	p
Normal weight	8.517	1	0.004
Overweight	5.134	1	0.023
Diabetes mellitus	22.030	1	0.000
Hypothyroidism	7.265	1	0.007
Polypharmacy	15.464	1	0.000

The information of 213 older adults was analyzed, with their baseline characteristics presented in table 1.

The factors associated with HTN as morbidity with greater frequency were analyzed; results are shown in table 2.

Normal weight is identified as a protective factor in 59%, while diabetes, polypharmacy, hypothyroidism, and being overweight are shown as risk factors for HTN.

Multiple logistic regression models were used to multivariate analyze the possible predictor variables for arterial hypertension. First, a bivariate analysis was performed.

As shown in table 3, the variables analyzed bivariate are initially associated with hypertension. Second, a predictive model is developed with the variables described above, showing the results in tables 4 and 5.

The global predictive capacity of the model is 70%, being able to predict hypertension by up to 25.5% with the variables used.

Only diabetes (odds ratio [OR] = 4.19) and polypharmacy (OR = 2.56) predict the occurrence of arterial hypertension in the analyzed model.

The relationship between the number of annual consultations and patients diagnosed with arterial

Table 4. Characteristics and properties of the model

Model summary		
Log-likelihood –2	**Cox and Snell R-squared**	**Nagelkerke R-squared**
242.61	0.191	0.255

Leaderboard			
Actual hypertension cases	**Hypertension (predicted)**		**% Correct**
	No	**Yes**	
Hypertension (observed)			
No	82	26	75.9
Yes	36	63	63.6
% global			70.0

Hosmer and Lemeshow test		
X^2	**gl**	**p**
11.205	7	0.130

Table 5. Variables in the equation

Variables	B	Standard error	Wald	gl	p	Exp (B)	95% CI	
							Lower	Superior
Normal weight	–0.511	0.456	1.256	1	0.262	0.600	0.245	1.467
Overweight	0.350	0.425	0.677	1	0.411	1.419	0.617	3.264
Diabetes mellitus	1.435	0.359	16.007	1	0.000	4.198	2.079	8.479
Hypothyroidism	0.694	0.430	2.614	1	0.106	2.003	0.863	4.648
Polypharmacy	0.941	0.323	8.510	1	0.004	2.562	1.362	4.822
Constant	–0.959	0.406	5.582	1	0.018	0.383		

β: beta; CI: confidence interval.

hypertension was analyzed using the Mann–Whitney U statistical test. The results indicated that patients with hypertension tend to make consultations with a significantly higher frequency compared to those who do not have this condition, as seen in table 6.

DISCUSSION

The significant prevalence of HTN among the population evaluated in the geriatric clinic, reaching 47.9%, reflects a reality in line with national statistics. In Mexico, approximately one in four citizens suffer from HTN, with a prevalence of 24.9% in men and 26.1% in women[3]. However, by adopting the new criteria of the American Heart Association (140/90 mmHg), it is anticipated that the incidence of HTN will be at least double, according to reports from the Ministry of Health in 2020[10]. The UNAM study in 2020[11] supports the seriousness of the situation, highlighting HTN as the main risk factor for mortality.

Based on the factors associated with HTN, diabetes emerges as the most frequent morbidity in this study and is shown as a significant risk factor. In this context, diabetes stands as the third cause of death in Mexico, with an alarming focus on the elderly population, occupying first place in terms of mortality[5]. These data highlight its relevance as a risk factor for developing hypertension, which aligns with statistics from the American Diabetes Association. This association is reflected in a prevalence of 20-60% of hypertension in people with diabetes mellitus[12].

Table 6. Relationship between the number of consultations in patients with and without arterial hypertension

Parameter	With hypertension	Without hypertension	p*
Number of medical consultations (X[s])	(7.22 [5.209])	(5.48 [5.212])	0.005

*(Mann–Whitney U, p = 0.005) 95% CI. CI: confidence interval; p: p value; X: mean; s: standard deviation.

These conditions often occur together and contribute to the public health burden. Polypharmacy is commonly seen in this patient population. In Mexico, the Clinical Practice Guide for Pharmacological Prescription in the Elderly establishes polypharmacy as more than three medications[13]. With a reported prevalence of 22.45% among individuals aged 60-69 and 25.33% among those aged 70-79, this study found a prevalence of 37.9%. The risks of polypharmacy and the possibility of inadequate therapy are alarming because they influence aspects of patient safety, favoring adverse drug events, medication errors, cascade prescription, poor adherence, increased risk of hospitalization, hospital readmissions, and mortality[15]. The condition is presented as a risk factor for HTN in the study.

In addition, a weight considered normal or ideal according to BMI is identified as a protective factor in 59%; on the contrary, overweight is shown as a risk factor associated with hypertension, coinciding with previous research[16-19] that links blood pressure (BP) with weight gain over time. According to the BMI ranges published in 2022 by the National Center for Chronic Disease Prevention and Health Promotion[6], the study population has BMI levels higher than normal by 62.4%, with 46% overweight, 10.3% with obesity, and 6.1% with morbid obesity, suggesting a worrying upward trend in HBP.

In addition to the relationship between weight and HTN, another associated risk factor in the study was hypothyroidism. Hypothyroidism in the elderly is a serious clinical condition that is related to significant morbidity. Prevalence rates vary depending on whether they are included or not in patients who take thyroid hormone, but most surveys report that approximately 1-3% of subjects over 60-65 years of age in the world have hypothyroidism[20]. Hypothyroidism has been recognized as a cause of secondary hypertension. Previous studies on the prevalence of hypertension in subjects with hypothyroidism have shown HTN values, suggesting that the possible link between hypothyroidism and diastolic hypertension is increased peripheral vascular resistance and low cardiac output[21].

Consequently, the economic burden associated with HTN is significant, consuming approximately 13.95% of the annual health budget[17]. The relationship between the number of consultations per year in the geriatric clinic was analyzed, and patients suffering from hypertension made use of the greatest of this service 7.22 consultations to 5.48 of those who do not suffer from it. The evident correlation between the number of consultations and the presence of HTN emphasizes the need for proactive management.

CONCLUSION

Comparing to literature, previous studies have reported hypertension prevalence in older adults in Mexico ranking between 60% and 70%, which is consistent with our findings. For instance, ENSANUT 2016 found a prevalence of 60% in older adults, aligning with our results. Furthermore, research conducted in other Latin American countries also reports similar prevalences, suggesting that hypertension in older adults is a widespread issue in the region. Risk factors identified in our study, such as advanced age and elevated BMI, have consistently been report in the literature as key determinants of hypertension.

Healthcare professionals should prioritize strategies that promote healthier lifestyles among older adults affected by HTN, emphasizing the significance of remaining physically active. Numerous studies support the beneficial health effects of exercise[22-25]. These include reducing BP, improving cardiovascular fitness, weight loss, and preventing and controlling chronic diseases such as hypertension[26-29].

Hypertension can be prevented by reducing risk factors such as tobacco, alcohol, a sedentary lifestyle, and an inadequate diet. A healthy lifestyle is associated with an 80% reduction in the risk of developing these types of diseases, according to the WHO. In the present study, 213 patients were previously analyzed, of which 101 (47.9%) suffered from HTN.

Lifestyle modification, with exercise as an essential component, is positioned as the best way to prevent, treat, and control HTN.

Exercise programs, particularly those that incorporate aerobic activity and counter-resistance work, are shown to be effective in preventing the development of hypertension and reducing BP. In our sample, patients with HTN attended the clinic more frequently, which underlines the importance of ongoing care and monitoring. Exercise not only has immediate effects, with BP decreasing up to 22 h after a session, but also contributes to a significant chronic reduction[30].

It is evident that after weeks of physical training, a decrease in systolic BP is achieved, associated with reductions in morbidity from heart disease and stroke, as well as in general mortality. Small reductions in BP, even 2 mmHg, are linked to a substantial decrease in the risk of cardiovascular events[30]. In the specialized geriatric clinic, hypertension stands out as the main condition, although it is worrying that a high percentage of patients (76.1%) admit to not doing any physical activity. These data reinforce the need for interventions aimed at promoting active aging and highlight the urgency of adopting preventive and therapeutic measures focused on exercise to improve the health of this population.

Furthermore, it is essential that healthcare personnel adopt an optimal approach to reduce the risks associated with polypharmacy. This involves conducting periodic reviews of patients' medication lists, which may be adjusted to include, as appropriate, combination therapy and the use of single-pill combinations. It has been shown that combination therapy can achieve greater reductions in BP than monotherapy, in addition to improving the safety and tolerability of pharmacotherapy. Rational combination therapy may be key to maximizing BP and glycemic control, as well as optimizing the benefits of polypharmacy in elderly patients with comorbid hypertension and diabetes. It is essential that health professionals should be alert to these strategies to ensure the optimal well-being of their patients[31].

CLINICAL AND PUBLIC HEALTH IMPLICATIONS

This study presents several limitations that should be considered when interpreting the results. First, the cross-sectional design precludes establishing casual relationships between risk factors and arterial hypertension. Second, the sample is limited to retired older adults attending a geriatric clinic in Querétaro, which may restrict the generalizability of the findings to other populations. In addition, treatment adherence was assessed through self-report, potentially design, and a more diverse sample to validate these findings.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

ETHICAL CONSIDERATIONS

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors have followed their institution's confidentiality protocols, obtained informed consent from patients, and received approval from the Ethics Committee. The SAGER guidelines were followed according to the nature of the study.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Prevalence of frailty in the elderly with rheumatoid arthritis

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Abstract

Background: *Frailty is an aging-associated process that leads to increased vulnerability to disability, dependency, and death. Rheumatoid arthritis (RA) is a chronic autoimmune disease that can accelerate frailty in older adults.* **Objective:** *The objective of this study was to assess the prevalence of frailty in RA patients aged 60 years and above.* **Material and methods:** *We conducted a cross-sectional and observational study involving patients aged 60 years or older with RA, at the rheumatology clinic. Frailty was evaluated using the Ensrud criteria and the study of osteoporotic fractures index.* **Results:** *A total of 110 participants with RA were included, with a mean age of 67.2 ± 6.2 years. Among them, 97 (88.2%) were women. Polypharmacy was seen in 71 (64.5%) individuals. The most common comorbidity was obesity, affecting 85 (77.3%) participants. Based on the assessment, 20 (18.2%) were classified as frail, 47 (42.7%) as prefrail, and 43 (39.1%) as robust.* **Conclusion:** *This study revealed a high prevalence of frailty among elderly individuals with RA. The findings suggest the importance of finding prefrailty as it offers an opportunity for interventions to prevent advanced stages of frailty and overall decline in the health of older adults.*

Keywords: *Frailty. Prevalence. Older adults. Rheumatoid arthritis. Aging.*

Prevalencia del síndorme de fragilidad en adultos mayores con artritis reumatoide

Resumen

Antecedentes: *La fragilidad es un proceso asociado al envejecimiento que conduce a mayor vulnerabilidad a discapacidad, dependencia y muerte. La artritis reumatoide (AR) es una enfermedad autoinmune crónica que puede acelerar la fragilidad en los adultos mayores.* **Objetivo:** *Evaluar la prevalencia de la fragilidad en pacientes con AR de 60 años o más.* **Material y métodos:** *Se realizó un estudio observacional, transversal en pacientes de 60 años o mayores con AR, en la consulta de reumatología. La fragilidad fue evaluada usando los criterios de Ensrud y el índice SOF (study of osteoporotic fractures index).* **Resultados***: Se incluyeron un total de 110 participantes con AR, con edad media de 67.2 ± 6.2 años. De ellos, 97 (88.2%) eran mujeres. Se encontró polifarmacia en 71 (64.5%) individuos. La comorbilidad más común fue la obesidad en 85 (77.3%) participantes. Conforme con la evaluación 20 (18.2%) se clasificaron como frágil, 47 (42.7%) como prefrágil y 43 (39.1%) como robusto.* **Conclusión***: Este estudio reveló una alta prevalencia de fragilidad entre adultos mayores con AR. Se resalta la importancia de identificar la prefragilidad, ya que brinda una oportunidad para que las intervenciones prevengan las etapas avanzadas de fragilidad y el deterioro general de la salud de los adultos mayores.*

Palabras clave: *Fragilidad. Prevalencia. Adulto mayor. Artritis reumatoide. Envejecimiento.*

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INTRODUCTION

Aging is often associated with physical, mental, and social changes that affect the functioning of older individuals, leading to a decline in their autonomy. Among the various geriatric syndromes, frailty stands out as a significant concern due to its association with increased vulnerability to disability, dependency, and death[1-4]. Frailty, defined by Fried and colleagues as "a biologic syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, and causing vulnerability to adverse outcomes[5]", poses a substantial public health problem, given its economic impact. Previous studies have shown that frail patients with functional limitations incur twice the costs for medication, hospitalization, and general care[3]. A systematic review reported a frailty prevalence of 10.7% among adults aged 65 years or older residing in community housing[4]. In Mexico, in 2023, 14.7% of the total population corresponds to adults aged 60 and over, and it is estimated that this percentage will increase to 24.5% in 2050[6,7]. Frailty appears to be associated with chronic diseases that affect older adults[1-4,8].

Rheumatoid arthritis (RA) is a chronic disease that typically manifests in individuals over 40 years of age, with a prevalence of 1-6% in Mexico[9]. This implies that older adults have been living with the disease for 15-20 years. RA is a multi-organ condition characterized by chronic inflammation of peripheral joints[10]. The prevalence of RA increases with age, suggesting that more RA patients will develop geriatric syndromes in the future.

At present, there is no geriatric assessment that considers the specific risk factors of RA in relation to geriatric syndromes. It is possible that the physiological changes associated with aging are further worsened by RA itself or by the medications commonly used to treat RA. The advent of disease-modifying treatments has improved long-term survival in RA[10]. However, managing RA in geriatric patients will pose a challenge for rheumatologists in the coming decades as they strive to develop effective interventions that prevent disability and dependence in older adults.

A cross-sectional study using the cardiovascular health study index to define frailty found a prevalence of 23.4% in individuals aged 18 years and above with RA[1]. This study aims to evaluate the prevalence of frailty in RA patients over 60 years of age using a validated and user-friendly tool for defining frailty. Therefore, we seek to address the following research question through a cross-sectional, observational, and descriptive study: What is the prevalence of frailty among older adults with RA in our population?

MATERIAL AND METHODS

We conducted an observational and cross-sectional study at the Rheumatology Outpatient Clinic of the General Hospital of Zone No. 17, Mexican Institute of Social Security in Monterrey, Nuevo Leon, Mexico. The recruitment of participants took place from January 2021 to June 2022, and individuals aged over 60 years were included in the study. Evaluations were performed by specialists in rheumatology and geriatrics. The study was approved by the Local Ethics Committee with number R-2022-1904-209.

Consecutive identification of patients with a primary diagnosis of RA was done according to the classification criteria established by the American College of Rheumatology. Exclusion criteria encompassed individuals with physical and mental alterations unrelated to RA (patients with amputations), as well as those showing other rheumatic diseases (osteoarthritis, psoriatic arthritis, systemic lupus erythematosus, and Sjogren syndrome), prior diagnosis of frailty and an inability to respond to the frailty scale.

Participants' comorbidities were set up through direct questioning, and the consumption of three or more medications per day was considered indicative of polypharmacy, based on Mexican guides[11]. The participants' perception determined the classification of their family support network as good, regular, or bad using the multidimensional scale of perceived social support.

Frailty assessment was conducted using the Ensrud criteria, employing the study of osteoporotic fractures (SOF) Index[12] in which defines frailty by the presence of two or more of the following criteria: (1) weight loss of 5% or more in the past 3 years; (2) inability to rise from a chair 5 times without arm support; and (3) reduced energy level, as indicated by a negative response to the question: "Do you feel full of energy?;" which were applied in the medical appointment. Participants who had one criterion were classified as prefrail, while those not meeting any criteria were considered robust.

Within the spectrum of frailty, individuals who are active, energetic, and engage in regular exercise are considered robust. Those with symptoms of illness and subjective complaints of generalized weakness are considered vulnerable. Mild frailty refers to those

Table 1. Demographic characteristics

Characteristic	n = 110
Male (%)	13 (11.8)
Average age (± SD)	67.2 (± 6.2)
Civil status (%)	
Married	59 (53.6)
Divorced	7 (6.4)
Separated	4 (3.6)
Single	9 (8.2)
Widower	30 (27.3)
Free union	1 (0.9)
Scholarship (%)	
None	6 (5.5)
Preschool	4 (3.6)
Primary	47 (42.8)
Secondary	19 (17.3)
Preparatory	18 (16.4)
Professional	14 (12.8)
Postgraduate	1 (0.9)
Support network	
Good	76 (69.1)
Regular	28 (35.5)
Bad	6 (5.5)

SD: standard deviation.

Table 2. Clinical characteristics

Characteristic	n = 110
Comorbidities (%)	
Diabetes mellitus type 2	35 (31.8)
Chronic obstructive pulmonary disease	5 (4.5)
Chronic kidney disease	7 (6.4)
Systemic arterial hypertension	64 (58.2)
Ischemic heart disease	4 (3.6)
Heart failure	3 (2.7)
Cancer	2 (1.8)
Cerebral vascular disease	2 (1.8)
Depressive disorder	14 (12.7)
Liver disease	2 (1.8)
Osteoporosis	21 (19.1)
Arrhythmias	4 (3.6)
Thyroid disorders	15 (13.6)
Sleep disorders	38 (34.5)
Polypharmacy (%)	71 (64.5)
IMC (%)	
≤ 19	5 (4.5)
19-21	7 (6.4)
21-23	5 (4.5)
≥ 23	85 (77.3)

who need assistance with instrumental activities of daily living, while moderate frailty entails a need for help with both instrumental and basic activities of daily living. Severe frailty encompasses individuals who are entirely dependent on assistance for basic activities of daily living or have a terminal illness[13].

RESULTS

A total of 2000 patients were reviewed, and 110 patients aged over 60 years with a diagnosis of RA were included in the study. The average age of the patients was 67.2 ± 6.2 years. Among them, 97 (88.2%) were female, and 13 (11.8%) were male. In terms of marital status, 59 (53.6%) patients were married, and 30 (27.3%) were widowed. Forty-seven (42.8%) patients had completed primary school education, while 6 (5.5%) were illiterate. A good support network was reported by 76 (69.1%) patients; in contrast, 6 (5.5%) had a poor support network (Table 1).

The most prevalent comorbidities included obesity (body mass index ≥ 23) in 85 (77.3%) patients, high blood pressure in 64 (58.2%), sleep disorders in 38 (34.5%), type 2 diabetes mellitus in 35 (31.8%), and osteoporosis in 21 (19.1%). In addition, 71 (64.5%) patients were found to have polypharmacy (Table 2).

Based on the SOF index, 47 (42.7%) patients were classified as prefrail, 20 (18.2%) as frail or severely frail, and 43 (39.1%) as robust. According to the clinical frailty scale, 23 (20.8%) patients were classified as mildly, moderately, or severely frail, while 38 (34.5%) were classified as vulnerable (Table 3). In both scales, the percentage in frail was similar.

DISCUSSION

Aging is a process that renders individuals more vulnerable to physical, mental, and social changes. Among the major geriatric syndromes, frailty is particularly significant due to its impact on disability and dependence in the elderly. While there is no standardized definition of frailty and its biological basis remains unknown, it is believed that various inflammatory and immunological mechanisms contribute to a loss of physiological reserve, as seen in the advanced stages of RA[1].

In this study, frailty was assessed using the SOF index based on the Ensrud criteria[12]. The practicality of applying this index was preferred over the more detailed Fried's phenotype criteria used in previous studies, which require more evaluation time. The simplicity of the SOF index's application could encourage its use not only in geriatrics but also in other specialties, such as rheumatology, enabling preventive measures to be taken.

Table 3. Frailty scales

Scale	n = 110
SOF index (%)	
Robust	43 (39.1)
Pre-frail	47 (42.7)
Frail	20 (18.2)
CFS (%)	
Optimal state of health	16 (14.5)
Good health	11 (10)
Autonomous person	22 (20)
Vulnerable	38 (34.5)
Mild frailty	13 (11.8)
Moderate frailty	5 (4.5)
Severe frailty	5 (4.5)

CFS: clinical frailty scale.

A high frequency of frailty (18.2%) was found in patients with RA, compared to the 10.7% reported in a systematic review of patients over 65 years old[4], and slightly lower than the 23.4% reported in a study conducted at the National Medical Center Siglo XXI[1]. Similarly, a prevalence of prefrailty of 42.7% was seen, close to the 41.6% found in the systematic review[4]. The difference in frailty prevalence could be explained by the greater number of parameters evaluated in the Fried's phenotype criteria, while the prevalence of prefrailty is similar, highlighting an opportunity to develop tools for frailty prevention and the avoidance of deterioration in older adults. The comprehensive rheumatologic assessment of frailty has been adapted, translated, and used in a Vietnamese study as an instrument to appraise older adults with AR, whose results showed to have a strong validity in its population[14].

Another noteworthy outcome is the quality of the family support network reported by patients. Likely due to adequate support from their families, a decrease in frailty prevalence can be assumed compared to the study at the National Medical Center Siglo XXI[1]. Increased supervision and care of the elderly by family members may contribute to the decrease in functional deterioration, implying a decrease in frailty and an increase in prefrailty.

Most participants being female are expected due to the higher prevalence of RA in women[9]. In general, women with RA tend to show higher disease activity and faster disability progress compared to men[14,15]. A meta-analysis by Gao et al.[16] found that frailty prevalence in 33.5 in patients with RA and it was more prevalent in women, which was similar in our study.

Another expected finding was the presence of polypharmacy in 64.5% of the participants, comparable with the 65.2% in a study carried out in the Center for Rheumatology at Bach Mai Hospital[14], emphasizing the multisystem implications of RA often necessitate the use of multiple medications for optimal disease control. In addition, the increased survival of RA allows for the emergence of complications that require the long-term use of multiple medications.

About comorbidities, a high prevalence of disorders associated with metabolic syndrome was observed, with hypertension and obesity being the most common, followed by diabetes mellitus and osteoporosis. This is likely related to the use of medications for RA, including both steroidal and non-steroidal anti-inflammatory drugs.

It is important to promote further investigation into patients' medication in RA and its association to frailty. A study performed in San Francisco in patients with diagnosis of RA, found that the ones classified as frail and pre-frail had higher inflammatory markers, disease activity and levels of obesity than the robust group[17], these findings encourage medical professionals to maintain adequate control of RA, lead the patient to remission and a healthy lifestyle.

Several limitations exist in this study. The limited number of patients studied may not be representative, and the prevalence of frailty may be overestimated. In addition, the small number of items evaluated in the Ensrud criteria may not find borderline frail patients, potentially delaying the intervention by specialists. However, this could be compensated for by repeated evaluations of patients. It is suggested that future studies conduct random sampling and include several hospitals. The high number of female participants in this study, reflecting the higher prevalence of women with RA, may pose challenges when extrapolating the results to the male gender. Furthermore, long-term studies are needed to decide whether there are other factors associated with the rheumatic disease itself which could condition or promote frailty.

CONCLUSION

This study highlights a high prevalence of frailty and its close association with RA in the elderly population. While the results recommend screening for frailty in RA, we believe that identifying prefrailty would be of greater significance for intervention and prevention of advanced stages of frailty and overall deterioration in the elderly, besides maintain an adequate control of RA.

We propose continued efforts to investigate the paradigms of frailty and strive to promote healthy aging among older adults.

FUNDING

The authors declare that they have not received funding.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

ETHICAL CONSIDERATIONS

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors have obtained approval from the Ethics Committee for the analysis of routinely obtained and anonymized clinical data, so informed consent was not necessary. Relevant guidelines were followed. The study was approved by the Local Ethics Committee with number R-2022-1904-209.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Do we need geriatricians in the hospital? Effectiveness of follow-up with geriatrics to reduce in-hospital complications in older adults

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Abstract

Background: *The older person population is accompanied by an increased prevalence of diseases and a need for impatient care, often associated with complications.* **Objective:** *This study aims to establish a reduction of the incidence of in-hospital complications (IHC) as a benefit of combined geriatric care.* **Material and methods:** *A retrospective cohort was developed with patient's ≥ 78 years who received standard medical care and medical care in conjunction with geriatrics. Bivariate analyses were performed to compare the incidence of combined and individual IHC. Multivariate models were used to identify the factors associated with these complications.* **Results:** *The total population was 414 patients. Although the incidence of combined and individual IHC did not show significant differences, it is noteworthy that the outcome reflected a trend toward a reduction in the risk of in-hospital death with geriatric follow-up (relative risk 0.1, 95% CI 0.0-1.1, p > 0.05). A multivariate analysis established geriatric care as a statistically significant protective factor for inpatient mortality. In addition, a Charlson index of ≥ 10 and admission to the intensive care unit (ICU) were identified as risk factors for the same outcome.* **Conclusion:** *During hospitalization, combined geriatric follow-up reduces the risk of in-hospital mortality in older persons with a high comorbidity burden and admission to the ICU.*

Keywords: *Older person. Multimorbidity. Complications. Delirium. Mortality.*

¿Necesitamos geriatras en el hospital? Efectividad del seguimiento con geriatría para reducir complicaciones intrahospitalarias en adultos mayores

Resumen

Antecedentes: *En la población de personas mayores existe un aumento en la prevalencia de comorbilidades y uso de servicios de hospitalización que suelen acompañarse de complicaciones.* **Objetivo:** *Establecer el beneficio del seguimiento en conjunto con geriatría durante hospitalización de personas mayores para disminuir incidencia de complicaciones intrahospitalarias (CIH).* **Material y métodos:** *Cohorte retrospectiva con pacientes ≥ 78 años que recibieron cuidado médico estándar y cuidado médico en conjunto con geriatría. Se realizaron análisis bivariados comparando la incidencia de las CIH y modelos multivariados para identificar los factores asociados a dichas complicaciones.* **Resultados:** *La población total fue de 414 pacientes; aunque la incidencia de CIH combinada e individual no mostró diferencias significativas, cabe destacar que el resultado reflejó una tendencia hacia una reducción del riesgo de muerte hospitalaria con el seguimiento geriátrico (RR 0.1 IC 95% 0.0-1.1, p > 0.05). En el análisis multivariado de muerte intrahospitalaria, se estableció que la atención geriátrica es un factor de protección estadísticamente significativo para la mortalidad hospitalaria. Además, un índice de Charlson ≥ 10 y el ingreso en la Unidad de Cuidados Intensivos (UCI) se identificaron como factores de riesgo para el mismo desenlace.* **Conclusión:** *Durante la hospitalización, el seguimiento en conjunto con geriatría disminuye el riesgo de muerte intrahospitalaria en AM con una carga alta de comorbilidades e ingreso a UCI.*

Palabras clave: *Personas mayores. Multimorbilidad. Complicaciones. Delirium. Mortalidad.*

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INTRODUCTION

There has been a rise in the older adult demographic in Mexico. According to the United Nations: World Population Prospects 2019, in 2000, 7.3% of the population was over 60 years old, and by 2030 this percentage is expected to rise to 14.7%[1]. Concurrently, there is an increase in the prevalence of chronic diseases within this population, with 55% to 98% having at least two diseases, the most common being cardiovascular diseases led by ischemic heart disease[2-4].

Subsequently, their utilization of health services has increased. In Mexico, a retrospective study showed that older adults are 1.5 times more likely to be hospitalized (odds ratio [OR] 2.53, 95% confidence interval [CI]: 2.23-2.86) compared to children. The pathologies associated with this increased hospitalization demand were cancer (OR 2.95, 95% CI: 1.71-5.09), acute myocardial infarction (OR 2.47, 95% CI: 1.95-3.14), and stroke (OR 2.13, 95% CI: 1.27-3.58)[5].

Hospitalization in old age is not harmless; there is an increase in complications or injuries related to medical practice[6], with reported incidences ranging from 29%[7] to 38%[8]; 44% of them are preventable[9] and recognized by the medical community[10]. The most prevalent complications are[11]: adverse drug effects, falls, use of physical restraints, nosocomial infections, pressure ulcers, delirium, and complications related to surgeries.

Geriatrics main focus in the care of older adults is the mission to improve their health, function, and well-being. When this is not possible, it provides palliative care consistent with the patient's wishes[12]. Despite its holistic approach, the effectiveness of in-hospital geriatric care is still controversial[13].

Previously, a clinical trial aimed to verify the effectiveness of interdisciplinary geriatric management in frail older adults by measuring differences in functionality, care, or hospital stay duration (HSD), with no significant differences found ($p < 0.05$)[14]. In addition, a multicenter cohort compared adverse effects in patients with fractures in geriatric centers versus standard orthopedic care, reporting an increased risk (OR 4.56, 95% CI: 2.23 to 9.34) for adverse outcomes in the group receiving geriatric care[15].

Nonetheless, there is evidence showing more favorable outcomes; the Geriatric Assessment-Driven Intervention study compared standard oncological care against geriatric assessment-oriented interventions, with results supporting the latter approach, showing a 10.1% reduction (60.6% vs. 50.5%, $p < 0.05$) in the incidence of grade 3 or higher toxicity adverse effects[16]. Van Grootven et al.[17] compared standard care against geriatric care in a coronary unit, demonstrating in the latter better functional status at discharge (KATZ 8.9 vs. 9.5, $p < 0.05$) and a lower probability of functional decline (OR 0.5, 95% CI 0.3-0.8).

It is essential to reduce complications in older adults as these predispose the development of other unfavorable outcomes such as:

- A 4.3-fold increase in the probability of dying (OR 5.30, 95% CI 1.77-15.81) in emergency surgery[18].
- An increase in the risk of other in-hospital complications (IHC) (relative risk [RR] 1.6, 95% CI 1.4-1.8) once a post-operative complication and delirium are established[19].
- An increase in healthcare costs by up to 14%[20].

We hypothesize that the geriatric approach, which focuses profoundly on individualized preventive measures, such as anti-delirium measures, identification and treatment of geriatric syndromes, and medication reconciliation, could reduce the IHC. To verify this, this study was conducted with the primary objective of evaluating the effectiveness of combined standard medical and geriatric care compared to standard medical care alone in older adults ≥ 78 years for the reduction of a set of IHCs.

Secondary objectives included: describing the incidence of IHC and delirium, evaluating the effectiveness of combined geriatric care for the reduction of individual IHC (falls, pressure ulcers, reporting of adverse reactions, inappropriate initiation of benzodiazepines, in-hospital infections, venous thromboembolism, death from any cause [not palliative sedation]), and reducing HSD and readmission within 30 days, as well as identifying predictive factors for the onset or reduction of complications.

MATERIAL AND METHODS

A retrospective cohort study was conducted with patients aged ≥ 78 years treated at the ABC Medical Center (Fig. 1).

Patients hospitalized for ≥ 24 h in internal medicine, surgery, orthopedics, and the intensive care unit (ICU) were included. On the other hand, patients with three or more admissions in the past year and those admitted with invasive mechanical ventilation were excluded. Data were collected from the clinical records from October 2020 to October 2021.

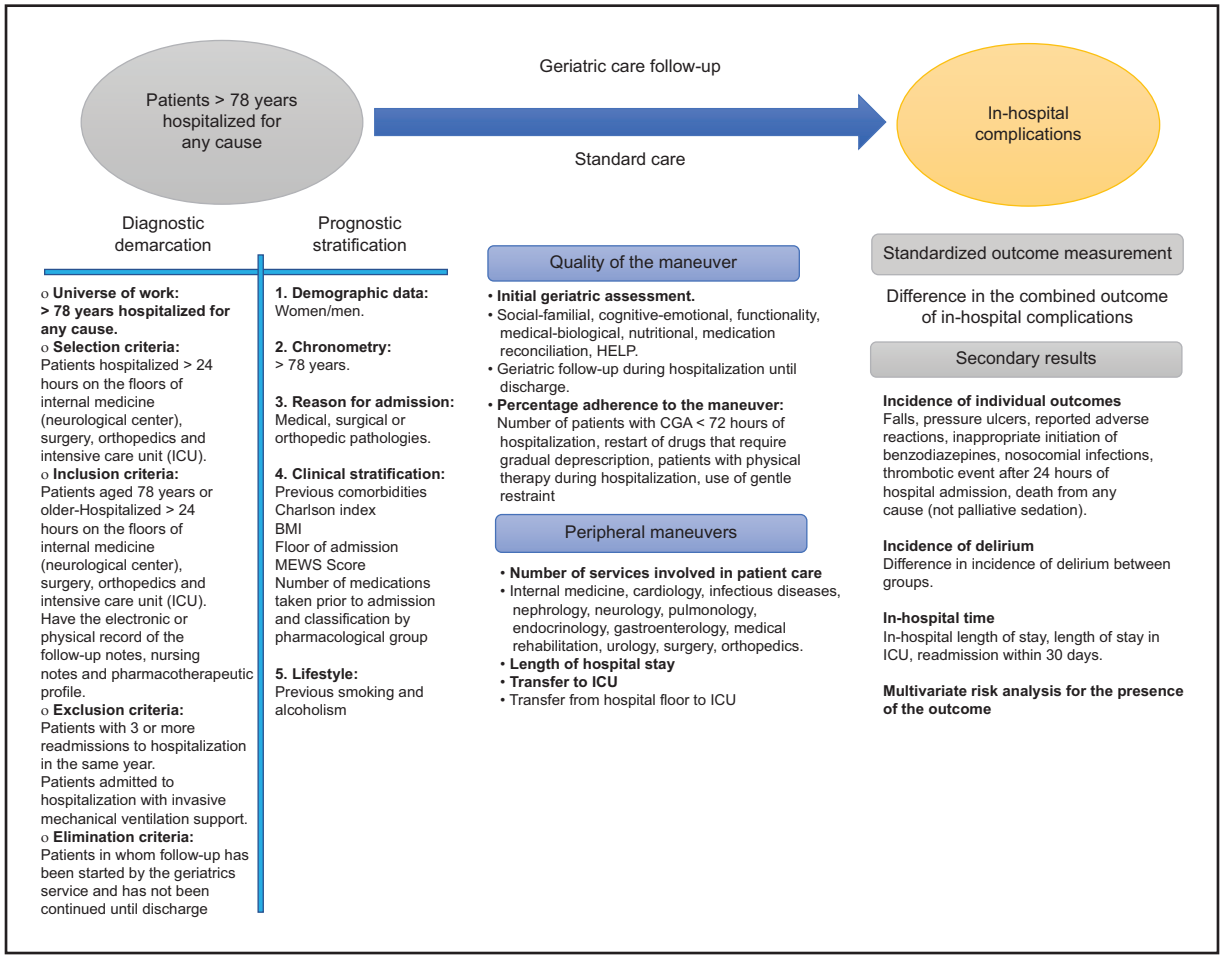

Figure 1. *Architectural model. Overview of the research project through its representation according to the architectural model. ICU: intensive care unit; MEWS: modified early warning score; HELP: hospital elder life program; CGA: comprehensive geriatric assessment.*

Patients were organized into two groups:

1. The intervention group received comprehensive geriatric assessment, daily delirium screening, and care and treatment recommendations
2. The control group received standard medical care, without the involvement of the geriatrics service.

The sample size was calculated using OpenEpi, setting a 95% statistical significance, an 80% power, a prevalence difference of 16%, and an exposed/non-exposed ratio of 2:1 (according to the highest current ratio of patients without geriatric follow-up).

A total of 366 patients (122 in the geriatric group and 244 with standard care) was obtained, and a 10% increase in the sample was decided upon (134 in the intervention group, 268 in the standard group). Statistical analysis was performed using IBM Statistical Package for the Social Sciences Statistics 28.

Means and standard deviations were used to evaluate quantitative variables with normal distribution, medians and interquartile ranges for non-normally distributed quantitative variables, and percentages for qualitative variables. For the analysis of quantitative variables, Student's t-test or Mann–Whitney U was used, for dichotomous qualitative variables: Pearson's X^2 (if values were > 5) or Fisher's exact test (if values were < 5), and for ordinal qualitative variables: Mann-Whitney U.

In the multivariate analysis, three models were conducted using binary logistic regression to identify risk factors associated with IHC, with variable selection performed based on clinical and biological plausibility. A statistical significance of 95% was imposed, with a $p < 0.05$. This study was approved as a no-risk study by the ethics committee of both the ABC Medical Center and Anáhuac University.

Table 1. General characteristics of the population

Variable	Standard (n = 269)	Geriatric care (n = 145)	p
Age, median (IQR), years	83 (80-86)	83 (80-87)	0.24
Male (%)	142 (34.3)	65 (15.7)	0.12
Weight, median (IQR), kg.	70.0 (60-80)	69.0 (58-78)	0.12
Height (IQR), m	1.67 (1.60-1.73)	1.65 (0.09)	0.08
BMI, median (IQR), kg/m^2	25.0 (22.9-27.8)	24.7 (22.6-27.6)	0.53
Charlson Index, median (IQR).	5 (4-6)	5 (4-6)	0.21
MEWS Score, median (IQR).	1 (1-2)	1 (1-2)	0.52

No statistically significant differences were found in the general characteristics of the population. All variables had non-normally distribution. Analyzed using the Mann-Whitney U test. IQR: interquartile range; BMI: body mass index.

RESULTS

The total number of patients aged ≥ 78 years was 1067, of which 106 were excluded due to lack of electronic records and 18 due to duplication. A total of 943 patients were randomized, selecting 414 (269 in the standard care group, and 145 in the geriatric care group) based on the mentioned criteria.

During data cleaning, no missing values were found for quantitative variables, and for qualitative variables, missing values were imputed using the mode.

The population consisted of 50% men, with 34.3% in the standard care group and 15.7% in the intervention group (Table 1). There were no significant differences in weight, height, body mass index (BMI), Charlson index, MEWS Score, and history of smoking between the groups ($p > 0.05$) (Table 2). However, dementia was more prevalent in the intervention group (5.6% vs. 4.8%, $p < 0.01$).

The previous use of home medications in the geriatric group had a median of 6 versus 5 in the standard group ($p < 0.01$). The use of antidepressants (n = 50 vs. 48), benzodiazepines (n = 51 vs. 43), antiarrhythmics (n = 82 vs. 59), thyroid medications (n = 59 vs. 46), and antiulcer medications (n = 71 vs. 57) was higher in the standard care group, all of which were statistically significant differences ($p < 0.05$).

In regard to the reason for admission, there were no differences between medical, surgical, or orthopedic reasons ($p > 0.05$). The most common ward for admission in both groups was internal medicine (n = 123), followed by surgery (n = 120), orthopedics (n = 98), and lastly intensive care (n = 73), with no differences found ($p > 0.05$).

For the primary objective, the incidence of combined IHC was 109 (26.3%), with 71 (17.1%) in the standard care group and 38 (9.2%) in the geriatric care group. However, these differences were not statistically significant (RR 0.9, 95% CI 0.7-1.3, $p > 0.05$) (Table 3 and Fig. 2).

Among the secondary objectives, only one episode of falls (0.2%) was recorded in both groups, and pressure ulcers occurred in 21 patients (5.1%) in the standard group and 16 (3.9%) in the geriatric group ($p > 0.05$). Four episodes of adverse drug reactions (1%) were reported, all in the standard care group ($p > 0.05$). Noticeably, inappropriate initiation of benzodiazepines was more frequent in the standard care group (8.7% vs. 3.4%) ($p > 0.05$).

As for nosocomial infections, pneumonia represented the most common complication with a total of 14 episodes (3.4%), of which 10 (2.4%) occurred in the standard group and only 4 (1%) in the geriatric group ($p > 0.05$). Thrombotic events occurred in seven patients (1.7%), four (1%) in the standard group and three (0.7%) in the geriatric group ($p > 0.05$). Noticeably, 69 patients developed delirium (16.7%), 32 (7.7%) in the standard group and 37 (8.9%) in the geriatric care group ($p < 0.01$), which exhibited a significant rise in the risk of delirium detection in the geriatric care group (RR 2.1, 95% CI 1.3-3.2).

A total of 13 patients (3.1%) who faced inpatient mortality were reported, 12 patients (2.9%) pertaining to the standard group and one patient (0.2%) to the geriatric group, nonetheless, these differences were not significant statistically ($p > 0.05$). In addition, readmissions within 30 days were more frequent in the standard group (5.3% vs. 3.9%) ($p > 0.05$).

The results exhibited the standard care group had a median hospital stay of 4 days, compared to 5 days for the geriatric group ($p < 0.01$). Regarding ICU stay,

Table 2. Personal pathological history of standard group and geriatric care group

Variable	Standard (n = 269) (%)	Geriatric care (n = 145) (%)	p
Smoking history	111 (26.8)	63 (15.2)	0.66
History of alcoholism	53 (12.8)	40 (9.7)	0.06
Neurological pathologies			
Dementia	20 (4.8)	23 (5.6)	< 0.01
Stroke or TIA	26 (6.3)	21 (5.1)	0.14
Hemiplegia	2 (0.5)	1 (0.2)	1.0
Parkinson's disease	13 (3.1)	14 (3.4)	0.05
Epilepsy	2 (0.5)	1 (0.2)	1.0
Cardiovascular pathologies			
Systemic arterial hypertension	167 (40.3)	100 (24.2)	0.16
Atrial fibrillation	45 (10.9)	22 (5.3)	0.68
Acute myocardial infarction	45 (10.9)	19 (4.6)	0.33
Heart failure	36 (8.7)	17 (4.1)	0.63
Pacemaker placement	17 (4.1)	19 (4.6)	0.01
Venous insufficiency	13 (3.1)	12 (2.9)	0.16
Venous thrombosis	20 (4.8)	16 (3.9)	0.21
Pulmonary pathologies			
COPD	24 (5.8)	19 (4.6)	0.18
Chronic lung disease	15 (3.6)	16 (3.9)	0.04
Asthma	3 (0.7)	1 (0.2)	0.67
Gastro-metabolic pathologies			
Type 2 diabetes	62 (15)	38 (9.2)	0.47
Dyslipidemia	34 (8.2)	33 (8.0)	< 0.01
Hypothyroidism	57 (13.8)	48 (11.6)	< 0.01
Liver disease	6 (1.4)	4 (1.0)	0.73
Peptic acid disease	20 (4.8)	15 (3.6)	0.31
Cholecystectomy	35 (8.5)	19 (4.6)	0.97
Bowel resection	16 (3.9)	14 (3.4)	0.16
Nephro-urinary pathology			
Chronic kidney disease	23 (5.6)	5 (1.2)	0.06
Prostatic hyperplasia	52 (12.6)	24 (5.8)	0.48
Prostatectomy	33 (8.0)	11 (2.7)	0.14
Oncological			
Neoplasms	66 (15.9)	31 (7.5)	0.47
Leukemias	1 (0.2)	1 (0.2)	1.0
Lymphomas	4 (1.0)	0 (0)	0.30
Metastasis	6 (1.4)	2 (0.5)	0.71
Others			
AIDS	-	-	-
Fragility fracture	27 (6.5)	23 (5.6)	0.08

Regarding personal pathological history, there are significant differences only in the variables: dementia, history of pacemaker, chronic lung disease, dyslipidemia, and hypothyroidism. The rest of the variables have an adequate distribution between the groups. TIA: transient Ischemic attack; COPD: chronic obstructive pulmonary disease; AIDS: acquired immunodeficiency syndrome.

the median for the standard group was 5 days versus 6.5 days for the geriatric group ($p > 0.05$). A first multivariate analysis model was performed with the variables of: geriatric follow-up, BMI, Charlson index, MEWS Score, previous number of medications, reason for admission, hospitalization floor, HSD, number of services involved, and transfer to the ICU, the model explains 28% of the cases (R^2 0.28). The only variables that maintain statistical significance were: BMI ($p < 0.05$), MEWS Score ($p < 0.05$), HSD ($p < 0.01$), and ICU transfer ($p < 0.05$).

A second multivariate analysis model was performed using the stepwise method; significant variables from the previous model and the outcome of delirium were included, due to their statistically significant differences. This model explains 25% of the

Table 3. Study outcomes. In-hospital complications in both groups

Outcome	Total (n = 414) (%)	Standard (n = 269) (%)	Geriatric care (n = 145) (%)	Relative risk (95% CI)	p
Combined IHC	109 (26.3)	71 (17.1)	38 (9.2)	0.9 (0.7-1.3)	0.96
Falls	2 (0.5)	1 (0.2)	1 (0.2)	1.8 (0.1-29.4)	1.0
Pressure ulcers	37 (8.9)	21 (5.1)	16 (3.9)	1.4 (0.7-2.6)	0.27
Adverse drugreactions	4 (1.0)	4 (1.0)	0 (0)	NA	0.30
Inappropriate initiation of BZD	50 (12.1)	36 (8.7)	14 (3.4)	0.7 (0.4-1.2)	0.26
Pneumonia	14 (3.4)	10 (2.4)	4 (1.0)	0.7 (0.2-2.3)	0.77
Urinary tract infection	9 (2.2)	3 (0.7)	6 (1.4)	3.7 (0.9-14.6)	0.07
Surgical wound infection	2 (0.5)	1 (0.2)	1 (0.2)	1.8 (0.1-29.4)	1.0
Catheter infection	5 (1.2)	3 (0.7)	2 (0.5)	1.2 (0.2-7.3)	1.0
Thrombotic event (PE, stroke, IAM)	7 (1.7)	4 (1.0)	3 (0.7)	1.3 (0.3-6.1)	0.70
Delirium	69 (16.7)	32 (7.7)	37 (8.9)	2.1 (1.3-3.2)	< 0.01
In-hospital death	13 (3.1)	12 (2.9)	1 (0.2)	0.1 (0.0-1.1)	0.07
Readmission after 30 days	38 (9.2)	22 (5.3)	16 (3.9)	1.3 (0.7-2.4)	0.33

No statistically significant differences were observed in the combined in-hospital complications or in their individual breakdown. Delirium was detected more frequently in the geriatric care group. IHC: in-hospital complications; PE: pulmonary embolism; AMI: acute myocardial infarction; BZD: benzodiazepines; NA: not applicable.

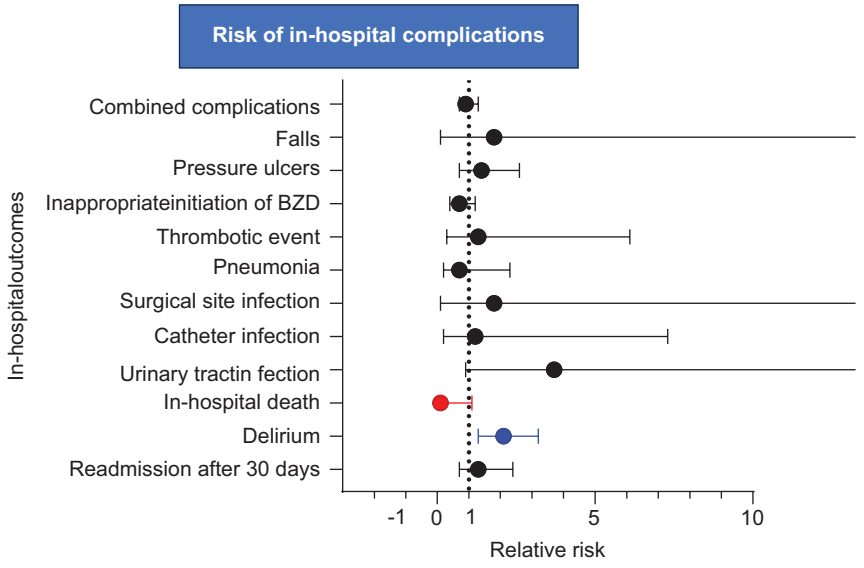

Figure 2. *Forest plot. In-hospital complications. There are no statistically significant differences in the combined in-hospital complications or in their individual breakdown, however, there is a trend toward a reduction in the risk of in-hospital death in the geriatric care group and an increase in the risk of detection of delirium in this same group. BZD: benzodiazepines.*

cases (R^2 0.25); delirium ($p < 0.01$), hospital stay longer than 5 days ($p < 0.01$), and admission to the ICU ($p < 0.05$) maintained their statistical significance and had OR > 1, hence identifying as risk-increasing factors. However, obesity ($p < 0.05$) had an OR < 1, which suggested it as a risk-reduction factor for IHC. The MEWS Score > 5 points did not maintain statistical significance in this model (Table 4).

In spite of its lack of statistical significance, due to its clinical significance, a multivariate analysis was

Table 4. Model 2 of multivariate analysis on in-hospital complications

Variable	β	Odds ratio (95% CI)	p	R^2
Delirium	1.61	5.03 (2.7-9.3)	< 0.01	0.25
Length of hospital stay > 5 days	0.73	2.09 (1.24-3.53)	< 0.01	
MEWS > 5 points	1.18	3.28 (0.72-14.95)	> 0.05	
Obesity (BMI > 30 kg/m^2)	–0.92	0.39 (0.16-0.96)	< 0.05	
Admission to intensive care	0.65	1.92 (1.02-3.61)	< 0.05	
Constant	–1.85		< 0.01	

This model explains 28% of the factors associated with IHC, the statistically significant variables are: delirium, length of hospital stay > 5 days, obesity, and admission to intensive care. MEWS: modified early warning score; BMI: body mass index; kg: kilograms; m^2: square meter; IHC: in-hospital complications.

Table 5. Multivariate analysis model on the outcome of in-hospital death

Variable	β	Odds ratio (95% CI)	p	R^2
Charlson index > 10 points	3.46	31.83 (4.34-233.22)	< 0.01	0.37
Admission to intensive care	3.65	38.71 (6.95-215.61)	< 0.01	
Geriatric care follow-up	–2.35	0.09 (0.00-0.95)	< 0.05	
Delirium	0.24	1.27 (0.33-4.79)	0.72	
Constant	–5.15		< 0.01	

This model explains 37% of the factors associated with in-hospital mortality, the factors that increase the risk are the Charlson index > 10 points and admission to ICU, in contrast with following up with geriatrics, which decreases this risk.

conducted for the outcome of in-hospital mortality. This model explains 37% of the cases (R^2 0.37), all variables maintaining statistical significance except for delirium. The Charlson index and ICU admission had OR > 1, thus they are considered risk factors. On the other hand, geriatric care was determined as a factor that decreased the risk of in-hospital mortality as it resulted in an OR < 1 (Table 5).

Consecutively, this model explained 37% of the factors associated with in-hospital mortality, the factors that increased the risk are the Charlson index > 10 points and admission to ICU, in contrast with following up with geriatrics which decreased this risk.

DISCUSSION

This study's purpose was to demonstrate the utility of geriatric care within the hospital setting. Although the main goal was to show a reduction in IHC, this cohort did not observe significant differences in the analysis of complications, either combined or individually.

However, once factors that could be associated with this lack of significant differences were considered, we noticed the relevance of the peripheral maneuvers related to the presence of multiple quality-of-care programs at our center and the low statistical power resulting from the small observed effect size.

Consequently, the certifications held by ABC Medical Center, awarded by the Joint Commission International[21] and the General Health Council[22], had ensured compliance with high standards of safety and quality in medical care, influencing the risk of complications such as surgical wound infections (RR 0.72, 95% CI 0.59-0.88)[23], falls (RR 0.71, 95% CI 0.55-0.90)[24], and venous thromboembolism (RR 0.55, 95% CI 0.32-0.96)[25].

Regarding the second factor, although a sample size calculation was performed before the study started, it was based on a difference of 16% derived from the literature[26]. The difference in proportions in our study was 7.9%, which yields a Cramer's V effect size of 0.002 (weak effect size) and, consequently, a statistical

power of 53% (lower than calculated), thus there is a high probability of committing a Type II error.

The detection of delirium by the geriatric care group showed a higher incidence (16.7% vs. 7%). At first glance, this analysis could be interpreted as suggestive of geriatric care increasing the risk of delirium. Nevertheless, as observed in the study by Blauth et al.,[15] where there was also a higher incidence of delirium in a geriatric fracture center versus a standard one[26], this trend was derived from the geriatrician's training in detecting this condition proficiently.

Delirium has been demonstrated to lead to multiple clinical consequences, such as; an increased risk of death from persistent delirium (Hazard Ratio [HR] 2.9, 95% CI 1.9-4.4)[27], use of physical restraints (6.4% vs. 0%, $p < 0.01$), falls (3.7% vs. 0%, $p < 0.01$), increased length of hospital stay (24.76 vs. 17.71 days, $p < 0.01$)[28], and the risk of progressing to major cognitive impairment (OR 2.3, 95% CI 1.85-2.86)[29]. Considering this, we can highlight among the prominent roles of the geriatrician in the inpatient setting would be the prevention, timely detection, and treatment of delirium, thereby avoiding its clinical consequences. This can be observed in the study by Chong MS et al.[30], where geriatric follow-up reduced functional decline, use of physical restraints, and improved family satisfaction with care.

As for the factors related to IHC observed in the multivariate analyses, delirium, hospital stay ≥ 5 days, and admission to the ICU are factors that increase the risk, while obesity is noted as a protective factor. We recommend a cautious interpretation of obesity as a protective factor, as this result could be influenced by other factors (fat distribution, sarcopenia, physical capacity) that indirectly modify outcomes, a phenomenon known as the obesity paradox[31].

It is pertinent to emphasize the trend in mortality reduction; our study recorded 13 deaths, yet only one was within the geriatric group, these differences were not statistically significant (RR 0.1, 95% CI 0.0-1.1, $p > 0.05$). A possible explanation derives from the low statistical power (31.3%) of this sample size, which increased the risk of committing a Type II error. Notwithstanding, it is valuable to recognize the clinical significance of this result through the calculation of the relative risk reduction of 84.8%, the absolute risk reduction of 0.037, and the number needed to treat of 26 patients. In other words, with geriatric care, it is necessary for at least 26 patients to be treated to observe a decreased in-hospital mortality risk in one patient.

The systematic review with meta-analysis conducted by the Cochrane Library[32] and by Rubenstein et al.[33] showed that geriatric interventions do not significantly reduce mortality during hospitalization. However, Rubenstein et al.[33] conclude that the impact of geriatric programs is only observed in select patients, depending on their clinical characteristics, namely intensive interventions and long-term follow-up. This statement was corroborated in our study through the multivariate analysis where geriatric care proved its benefit as a protective factor, provided that patients had a high burden of comorbidities (Charlson Index ≥10) or were admitted to the ICU.

CONCLUSION

Geriatric follow-up enhances the opportune detection of delirium and reduces the risk of in-hospital mortality in patients with a high burden of comorbidities and those admitted to the ICU, although it did not demonstrate a reduction in the risk of combined IHC.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

ETHICAL CONSIDERATIONS

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The authors have obtained approval from the Ethics Committee for the analysis of routinely obtained and anonymized clinical data, so informed consent was not necessary. Relevant guidelines were followed.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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Sarcopenia, frailty, and fractures in the Orthogeriatric Unit at the National Institute of Rehabilitation

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Abstract

Background: *There are close links between frailty, sarcopenia, and osteoporosis and the occurrence with falls and fragility fractures.* **Objective:** *The objective of this study was to determine sarcopenia in fracture patients of an Orthogeriatric Unit.* **Material and methods:** *A transversal study was conducted in 62 older adults, hospitalized with fragility fracture from March 2022 to October 2023. Based on the European working group on Sarcopenia in older people2 algorithm for the confirmation diagnosis, we used dual-energy X-ray absorptiometry (DXA).* **Results:** *Sixty-two patients, 79% of whom were women, median age of 83.5 years, interquartile range (IQR) (76.7-87 years). Detected fall factors were extrinsic in 60%. DXA performed on 49 patients and confirmed sarcopenia in 31%. Barthel index median was 87.5 (IQR 75-100). We only detect significant differences in frequency of male sarcopenic fractured patients (OR = 1.64 [95% CI 1.16-2.31]). Some correlations between the age and functional independence, disability perception, FRAX C, and albumin: R = –0.302 (p = 0.017), R = 0.302 (p = 0.018), R = 0.405 (p = 0.003), and R = –0.372 (p = 0.009), respectively, were detected.* **Conclusion:** *Sarcopenia is a musculoskeletal disease associated with increase of falls and fractures, but it is not the only factor we should consider as the main risk of major fracture.*

Keywords: *Orthogeriatric unit. Sarcopenia frailty. Fragility fractures. Falls.*

Sarcopenia, fragilidad y fracturas en la Unidad de Ortogeriatría en un Instituto Nacional de Rehabilitación

Resumen

Antecedentes: *Existe relación entre fragilidad, sarcopenia y osteoporosis con caídas.* **Objetivo:** *Determinar sarcopenia en una Unidad de Ortogeriatría.* **Material y métodos:** *Se realizó un estudio transversal. Se incluyeron 62 pacientes, de marzo del 2022 a octubre 2023. Basados en el algoritmo de sarcopenia establecido por la EWGSOP 2 (European Working Group on Sarcopenia in Older People), utilizamos la absorciometría dual de rayos X (DXA) para la confirmación.* **Resultados:** *62 pacientes, 79% fueron mujeres con una edad media de 83.5 años, rango intercuartil (RIC) (76.7-87 años). Factores extrínsecos en el 60%. DXA se realizó en 49 pacientes confirmando el diagnóstico en 31%. La media del Índice de Barthel fue 87.5% (RIC 75-100). La frecuencia de hombres con sarcopenia confirmada fue estadísticamente significativa (OR = 1.64 [IC 95% 1.16-2.31]). Se encontraron correlaciones entre la edad y la Independencia Funcional, percepción de la discapacidad, FRAX C y la albúmina: R = –0.302 (p = 0.017), R = 0.302 (p = 0.018), R = 0.405 (p = 0.003) and R = –0.372 (p = 0.009).* **Conclusión:** *La sarcopenia es una enfermedad muscular asociada al incremento de caídas y fracturas; pero no es el único factor que debemos considerar para establecer intervenciones ante el riesgo de fractura mayor.*

Palabras clave: *Unidad de ortogeriatría. Sarcopenia. Fragilidad. Fracturas por fragilidad. Caídas.*

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INTRODUCTION

Global population is experiencing growth and as a consequence life expectancy as well. Hip fractures are a public health problem with repercussions in function, presence of disability, and death in short and long term. The prevalence of hip fracture is increasing and there are several factors that are related, including age, desi nutrition, sarcopenia, and frailty[1]. The early recognition of these factors may influence the treatment and prevention of hip fractures.

According to the World Health Organization (WHO), fragility fractures result from minimal and low-energy trauma as falls from standing heights[2]. Fragility fractures are localized at hip, proximal humerus, distal radius, and vertebrae[3]. Osteoporosis and sarcopenia are acknowledged as one of the leading causes for fragility fractures[2].

Previous studies have investigated the effect of orthogeriatric trauma units on hip fracture patients. Implementation of these units decreases post-operative complications, readmission rates, and mortality[4-6].

Frailty increases the likelihood of falls, and potential fractures; on the other hand, osteoporosis and sarcopenia often coexist, this condition is known as osteosarcopenia. There are close links between frailty, sarcopenia, and osteopenia/osteoporosis with presence of falls[7].

We have different tools that can identify these geriatric syndromes, such as the frail index for fragility which divides patients in three categories (non-frail, pre-frail, and frail). For sarcopenia, we have the criteria of the European Working Group on Sarcopenia in Older People (EWGSOP2), that can identify different categories as normal, probable sarcopenia, sarcopenia and severe sarcopenia[3,8].

The presence of fragility fractures is of great interest due to its economic and public health impact, with an increased probability of disability at short and long term[3].

Since fractures lead to complications and have a negative impact on the patient and their social burden, we should consider that there is an imminent risk of fracture within two years of the initial fracture. It is important to identify factors related to falls and fractures[3,9].

OBJECTIVE

The objective of this study was to determine sarcopenia in older adults with a fragility fracture in Orthogeriatric Unit.

MATERIAL AND METHODS

We conducted an observational, descriptive, and analytical cross-sectional study. A total of 495 patients over 65 years old with a fragility fracture were hospitalized in the Orthogeriatric Unit between March 2022 and October 2023. Of these 62 patients were included in the present study based in the algorithm for sarcopenia established by the EWGSOP2, for the confirmation diagnosis of sarcopenia, appendicular skeletal muscle mass by dual-energy X-ray absorptiometry (DXA) in a Hologic Horizon W densitometer (S/N 301865M) was used. Pre-frail and frailty was assessed by a FRAIL questionnaire. Functional independence was measured by Barthel and KATZ index and perception of disability by the WHO Disability Assessment Schedule 2.0 (WHODAS).

SARC-F questionnaire was applied for sarcopenia screening at the 1st day of hospitalization and hand dynamometry was performed in dominant hand, supine, with elbow flexion at 90°, three intents with 30 s between each one, recording the highest.

Statistical analysis was conducted using the Statistical Package for the Social Sciences v 22. Non-parametric statistics were used for descriptive analysis, reporting median and interquartile range (IQR). Frequencies were reported as percentages. Fisher's exact test and Mann–Whitney U-test were used to analyze differences between proportions and medians, respectively. Spearman's correlation coefficient was used for quantitative variable analysis. Statistical differences were considered when $p \leq 0.05$.

The study was accepted by the Research Committee of the INR LGII with registration INR 45/22, considered minimum risk.

RESULTS

A study was conducted on 62 inpatients, 79% of whom were women, with a median age of 83.5 years, IQR (76.7-87 years). Fragility fractures were observed in the hip in 82% of cases, and in the humerus and radius in 18%. The detected fall factors were extrinsic in 60% and intrinsic in 40% of cases. Causes of falling are represented in table 1. The hospital stay was 13 days (IQR 10-15 days). The injury was surgically treated within 13 days (IQR 10-17 days).

The previous functionality of the patients, according to the KATZ index, was 51% A, 25% B, and 22% C-H. According to the Barthel index, 29% were independent, 56% had slight dependence, 6% had moderate

Table 1. Causes of falls

Factors	Causes	%
Intrinsic (n = 25)	Weakness	24
	Pain	16
	Dizziness	2
	Loss of balance	36
	Syncope	4
Extrinsic (n = 37)	Slip	40
	Stumble	60

dependence, and 3% had severe dependence, with a median 87.5 (IQR 75-100).

The previous perception of disability in patients was none in 3.2%, mild 29%, moderate 29%, and severe in 37%. The median of Mini-Mental State Examination was 18 (IQR 15-26). Geriatric syndromes detected included: previous falls in 39%, hearing impairment in 44%, visual impairment in 90%, urinary incontinence in 42%, fecal incontinence in 13%, constipation in 16%, edentulism in 93%, polypharmacy in 35%, and insomnia in 19%.

All 62 patients had a high probability of sarcopenia according to the SARC-F. DXA performed on 49 patients confirmed the presence of sarcopenia in 31 of them. Patients with confirmed sarcopenia and hip fracture had a lower median FRAX score for major osteoporotic fractures (FRAX M) [13 (IQR 10-18)] compared to those without sarcopenia [19 (IQR 13-26)], with a statistically significant difference (p = 0.04). There was a decrease in dynamometry at discharge in 50% of patients. According to the Frail score, patients were classified as prefrail in 48.4%, frail in 4.8%, and not frail in 46.8%. The most significant findings are that men are less likely to have sarcopenia, patients with sarcopenia are more likely to be edentulous, and patients with sarcopenia are more likely to have constipation. We resume the comparison of clinical characteristics between patients with and without sarcopenia confirmed by DXA in table 2.

The integral Rehabilitation Program consisted of physical and occupational therapy, lasting 10 days (IQR 7-10) and 10 days (IQR 1-14), respectively. In addition, they received educational activities for fall prevention, prolonged bed syndrome and anti-delirium recommendations.

Our findings in correlation analysis were generally weak but it is interesting to note that there are some significant correlations. Related to Function, there is a weak correlation between age, Functional Independence and Disability Perception as we expected: R = −0.302 (p = 0.017) and R = 0.302 (p = 0.018), respectively. Functional independence has weak correlation with albumin: R = 0.304 (p = 0.036) and there is a weak correlation between disability perception and SARC-F: R = 0.378 (p = 0.003). There is a moderate correlation between Mini-Mental with Frailty and Disability Perception: R = −0.549 (p = 0.015) and R = −0.533 (p = 0.019), respectively.

The risk of hip fracture FRAX C has correlated with the age R = 0.405 (p = 0.003). Albumin has weak correlation with hemoglobin R = 0.368 (p = 0.010). There is a weak negative correlation between SARC-F and creatinine: R = −0.333 (p = 0.008).

Regarding handgrip dynamometry, there is a weak correlation between appendicular DXA and initial handgrip strength: R = 0.462 (p = 0.001), incline DXA and initial handgrip strength: R = 0.323 (p = 0.027), and FRAX M and final handgrip strength: R = 0.308 (p = 0.050). Incline DXA also has a weak correlation with creatinine: R = 0.450 (p = 0.001)

51.6% of the patients were lost to follow-up. About 73% of the evaluated patients used walking aids, predominantly walkers. Two subsequent falls and one new fracture event were reported after hospitalization.

DISCUSSION

Sarcopenia is associated with a high risk of a wide range of adverse health outcomes, including poor overall and disease-progression-free survival rate, post-operative complications, and longer hospitalization in patients with different medical situations as well as falls and fracture, metabolic disorders, cognitive impairment, and mortality in general populations[10].

Reasons patients were excluded in this study which is contralateral fracture, poor cooperation due to dementia or delirium, post-operative pain, and difficulty to perform DXA in all patients.

One of the main difficulties in diagnosing sarcopenia in our hospitalized patients was the presence of metal artifacts from surgical implants in both extremities, as also reported by Yoo et al[11]. They suggest development of a method for evaluating muscle mass that reflects the clinical significance and prognosis after surgery. Ultrasound is recommended as a tool for evaluation of muscle mass as an alternative in hospitalized patients but currently are mainly used for research purposes[11]. Furthermore, biomarkers such as

Table 2. Comparison of clinical characteristics between patients with and without sarcopenia confirmed by DXA

Variable	Sarcopenia (n = 31)	Probable sarcopenia (n = 18)	p	OR	95% CI
Age (years)[a,b]	84 (78-87)	85.5 (77-89)	0.57	-	-
Sex Male (%)[c]	33	6	0.03*	0.17	0.02-1.23
Hip fracture (%)[c]	83	83	0.62	1.04	0.21-4.98
Hospitalization (days)[a,b]	13 (11-15)	14(9.7-16.2)	0.64	-	-
Time between injury and surgery (days)[a,b]	12 (10-15)	12.5 (8.7-27.7)	0.99	-	-
Barthel < 60 (%)[c]	13	17	0.51	1.30	0.32-5.13
Frax M[a,b]	12.5 (9.7-18)	18 (12-23)	0.52	-	-
Frax C[a,b]	5.75 (3.9-9.4)	7.1 (5.2-13.0)	0.11	-	-
Handgrip strength differential (kg)[a,b,d]	–0.9 (–2.6, 0.38)	–1.2 (–6.4, 0.2)	0.48	-	-
Vitamin D (ng/mL)[a,b]	14.7 (11.1-19)	17.3 (11.3-20.5)	0.61	-	-
Hemoglobin (g/dL)[a,b]	10.3 (9.6-12.9)	10.5 (9.8-12.8)	0.55	-	-
Albumin (g/dL)[a,b]	3.3 (2.9-3.7)	3.7 (3.2-4.0)	0.25	-	-
Creatinine (mg/dL)[a,b]	0.6 (0.5-0.7)	0.7 (0.6-0.9)	0.07	-	-
Frailty (n) [c]Pre-frail and Frail	17	9	0.49	1.21	0.38-3.89
Fall history (%)[c]	58	61	0.54	0.88	0.27-2.89
Hearing impairment (%)[c]	77	72	0.47	1.32	0.34-4.99
Visual impairment (%)[c]	90	94	0.53	0.55	0.05-5.71
Urinary incontinence (%)[c]	41	33	0.38	1.44	0.43-4.85
Fecal incontinence (%)[c]	13	17	0.51	0.74	0.15-3.77
Edentulism (%)[c]	45	16	0.04*	4.11	0.99-17.1
Polypharmacy (%)[c]	38	44	0.46	1.14	0.59-2.27
Constipation (%)[c]	9	0	0.01*	1.40	1.12-1.77
Insomnia (%)[c]	13	22	0.32	1.72	0.49-6.06
Cognitive Impairment (n)[c]	18	12	0.48	1.08	0.74-1.59
Reported falls after fracture (n)[c]	0	1	0.35	0.92	0.79-1.08
New fracture (n)	0	0	-	-	-
Physical activity prior to fracture (n)[c]	1	0	0.63	1.03	0.97-1.10

[a]Median (interquartile range); [b]Mann–Whitney U-test for median comparison; [c]Fisher's exact test for percentage comparison; [d]Differential (final handgrip-initial handgrip). *p ≤ 0.05. DXA: dual-energy X-ray absorptiometry.

creatinine and cystatin C could be used in the study of sarcopenia[12].

It is important for its early recognition because sarcopenia is a major determinant of recovery following hip fracture, and is associated with lower rates of walking recovery[13]. In the previous studies, the prevalence of pre-sarcopenia and sarcopenia in the older male and female population is the same[14]. The male population in our study represents 21%, the frequency of men with sarcopenia was higher than that of men without it.

It is important to consider that almost 70% of patients were independent/slightly dependent. More than 50% presented a history of fracture, sensory deficits, and reported a perception of disability moderate-to-severe, independently of presence or absence of sarcopenia. The other clinical characteristics were similar in both groups, so we have to consider a thorough assessment of the fall risk factors in addition to sarcopenia screening and FRAX score.

Although this study reports more days of hospitalization secondary to administrative challenges, compared

with other Orthogeriatric Units[15], we have few postoperative complications. We can suspect that dynamometry is reduced in half of the population as a result of an inpatient rehabilitation program established during hospitalization.

We have similar results as reported by Bae and Moon related to pre admission Barthel Index (87.5), which explain why more independent and functional individuals have a higher risk of falls, besides sarcopenia and frailty, we found more pre frail older adults[16].

Even if we reported more functional individuals, their perception of disability is higher by WHODAS 2.0, which could be explained by other factors such as cognitive impairment as we found in the present study. We should consider WHODAS 2.0 to also evaluate interpersonal relations, daily living activities, and participation.

Among intrinsic causes of fall, we report females, being 80 years or more, visual impairment, edentulism, and polypharmacy. Visual impairment could relate to extrinsic causes that increase risk of falls as Agudelo-Botero et al., reports. Some other health variables have been reported in association of occasional and recurrent fall in Mexican population as functional performance which we could not evaluate due to the acute fracture[17].

Biomarkers are used in the study of sarcopenia, lower levels of creatine are found on sarcopenic patients, as also was found in our population[18]. As reported by Luk et al., there is a relationship between lower levels of albumin and diminished Barthel Index. Low serum albumin level is associated with muscle breakdown and weaker muscle strength and future decline in muscle strength in older people[19].

Follow-up in our population is extremely important due to negative results in function and mortality. In our experience, barriers reported with lack of follow-up, were transportation, distance to hospital, poor social support, and low socioeconomic. Strategies have been implemented to diminish absenteeism for rehabilitation follow-up because we know that the effect of a previous history increased the risk of any clinical fracture (Hazard ratio, HR = 1.88; 95% CI = 1.72-2.07)[20].

The early identification of sarcopenia through DXA and targeted rehabilitation interventions could mitigate the risk of fractures and improve recovery outcomes in orthogeriatric patients. This highlights the need for integrating sarcopenia assessment into routine care protocol, and opportune attention in specialized services of Geriatrics and Rehabilitation.

CONCLUSION

We conclude that, although sarcopenia is a musculoskeletal disease whose relevance has increased in recent decades due to its association with falls and fractures, it is not the only factor to consider. As we found in the present study, probable sarcopenia is a major determinant for fracture. It is important to perform primary prevention and control of comorbidities, complications, and geriatric syndromes beside sarcopenia in primary healthcare attention, to improve quality of life in elderly. And in the Orthogeriatric Unit to identify, probable sarcopenia/sarcopenia is relevant to explore other rehabilitation interventions that contribute to secondary prevention and reduce the burden of this pathology.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

ETHICAL CONSIDERATIONS

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The study does not involve patient personal data nor requires ethical approval. The SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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THE JOURNAL OF LATIN AMERICAN GERIATRIC MEDICINE ORIGINAL ARTICLE

Relationship of obesity and overweight with complications in elderly patients undergoing coronary angioplasty

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Abstract

Background: *Ischemic heart disease is a significant global health concern, especially in older adults, due to its high mortality. Percutaneous coronary angioplasty is a common treatment, with a complication rate of 6% in this group. Body mass index (BMI) often fails to accurately reflect nutritional status, and debate persists on whether obesity and overweight serve as protective factors against post-procedural complications.* **Objective:** *To evaluate the association of obesity and overweight with in-hospital complications in elderly patients undergoing percutaneous coronary intervention (PCI).* **Material and methods:** *This retrospective, cross-sectional study was conducted in a tertiary care unit from August 2018 to December 2023. It included patients aged ≥ 70 years with chronic ischemic heart disease undergoing elective PCI. Sociodemographics, clinical variables, ischemic heart disease characteristics, and in-hospital complications were analyzed using descriptive and inferential statistics. Odds ratios (ORs) and confidence intervals (CIs) were calculated with Statistical Package for Social Sciences v26.* **Results:** *Of 294 patients (mean age: 74 ± 4 years), 70% (204) were male. Obesity and overweight prevalence rates were 24% and 45%, respectively. Hypertension was the most frequent comorbidity (81%; n = 237). Common complications included failure to restore blood flow (13%) and arterial dissection (13%). Obese and overweight patients had fewer complications than those with normal BMI (OR = 0.24, 95% CI: 0.14-0.43; p < 0.001).* **Conclusion:** *Obesity and overweight were linked to fewer complications, supporting the obesity paradox. Nonetheless, BMI limitations warrant the use of additional body composition measures for more accurate evaluation.*

Keywords: *Elderly. Body mass index. Coronary angioplasty. Complications.*

Relación de obesidad y sobrepeso con las complicaciones en el adulto mayor intervenido de angioplastia coronaria

Resumen

Antecedentes: *La cardiopatía isquémica es una creciente preocupación de salud pública global, especialmente en adultos mayores, debido a su alta mortalidad. La angioplastia coronaria percutánea (ACTP) es un tratamiento eficaz, aunque presenta complicaciones en el 6 % de este grupo etario. El índice de masa corporal (IMC), pese a su uso frecuente, no siempre refleja con precisión el estado nutricional, y existe debate sobre el posible efecto protector de la obesidad y el sobrepeso ante complicaciones post-procedimientos.* **Objetivo:** *Analizar la relación entre obesidad, sobrepeso y complicaciones intrahospitalarias en adultos mayores sometidos a ACTP.* **Material y métodos:** *Estudio observacional, transversal y retrospectivo realizado en un hospital de tercer nivel entre agosto de 2018 y diciembre de 2023. Participaron adultos mayores de 70 años con cardiopatía isquémica crónica sometidos a ACTP electiva. Se recopilaron variables sociodemográficas, clínicas y complicaciones intrahospitalarias, analizadas con estadística descriptiva e inferencial mediante SPSS v26.* **Resultados:** *De 294 pacientes (edad promedio: 74 ± 4 años), el 70 % (204) eran hombres. La prevalencia de obesidad y sobrepeso fue del 24 % y 45 %, respectivamente. La hipertensión fue la comorbilidad más común (81 %). Las principales complicaciones fueron falta de reanudación de flujo (13 %) y disección arterial (13 %). Pacientes con obesidad y sobrepeso mostraron menor prevalencia de complicaciones (RM = 0.24, IC 95 %: 0.14–0.43; p < 0.001).*

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Conclusión: *La obesidad y el sobrepeso se asociaron con menos complicaciones, respaldando la paradoja de la obesidad. Es fundamental complementar el IMC con otras medidas para evaluar con mayor precisión.*

Palabras clave: *Adulto mayor. IMC. Angioplastia coronaria. Complicaciones.*

INTRODUCTION

Ischemic heart disease is a global public health concern, and its prevalence increases with age. One of the most common interventions used to treat this condition is percutaneous coronary angioplasty, which reduces symptoms and improves survival rates[1-3]. However, in elderly patients, this intervention may be associated with complications due to their specific characteristics, often resulting in worse outcomes. Body mass index (BMI) is a commonly used measure of the nutritional status of hospitalized elderly patients[4-6]. However, the conditions under which anthropometric measurements are obtained are often suboptimal, compromising BMI accuracy. This index estimates an individual's body mass without considering important variations, such as sex, age, or the proportion of fat and muscle, which are critical factors in evaluating nutritional and health status.

Elderly individuals with a normal BMI do not always reflect proper nutritional status. Many patients with a normal BMI may exhibit frailty and poorer clinical conditions when undergoing surgical interventions, which is associated with worse outcomes. There is conflicting evidence regarding whether obesity and overweight act as protective factors against post-operative complications in cardiovascular interventions[7-12]. At the UMAE 34 Cardiology Hospital, initial nutritional assessments were performed in patients hospitalized for heart disease. However, the potential protective relationship between overweight and obesity against complications following percutaneous coronary intervention (PCI) in elderly patients has not yet been documented[13,14]. This study aimed to evaluate this relationship, provide multidisciplinary recommendations to improve the nutritional and clinical conditions of patients upon scheduled admission for the intervention, and reduce post-operative complications, positively impacting cost reduction and institutional resource use. Recent studies indicate that in the population over 70 years of age, obesity and overweight may be associated with lower post-PCI mortality, although this benefit decreases in patients with a BMI > 25 kg/m^2. This research was made possible by data obtained from the cardiology service at UMAE 34, which provides routine in-hospital monitoring of the nutritional status of elderly patients.

The objective of this study was to demonstrate the impact of obesity and overweight on reducing complications associated with cardiac catheterization in patients over 70 years of age, thereby improving the quality of interventions and reducing complications in this age group.

MATERIAL AND METHODS

Study design

An analytical, cross-sectional, comparative, and retrospective study was conducted. The study was classified as No Greater than Minimal Risk and was approved by the local Research Ethics Committee and the Hospital Health Research Committee for data collection and research purposes, ensuring the anonymity of research subjects (Registration number: -2022-1902-017).

Participants

A total of 294 study subjects were included. Participants were adults over 70 years old with a history of chronic ischemic heart disease selected for elective 1st-time PCI with the presence of three or fewer underlying comorbidities. Patients with left main coronary artery disease, three-vessel disease, coexisting valvular heart disease, stage V chronic kidney disease, existing bradyarrhythmias, severe left ventricular dysfunction at rest or during exercise (LVEF < 35%), or severe pulmonary diseases requiring continuous oxygen were excluded. In addition, patients with incomplete medical records or missing height and weight data were excluded from the study.

Variables

The instrument used to collect patient data integrated sociodemographic information, diagnoses, PCI-related data, catheterization-related complications, and anthropometric and nutritional measurements. These measurements were obtained from each participant's medical records, with height and weight measured upon admission using stadiometers and scales by trained healthcare professionals.

BMI

BMI was calculated as weight in kilograms divided by the square of height in meters (BMI = weight [kg]/height [m^2]). Patients were categorized into three groups based on their BMI: normal, overweight, and obese.

Complications

In-hospital complications were grouped into five categories based on documented events in the medical record, including in-hospital mortality, complications during PCI, vascular access site-related complications, complications occurring within 72 h post-procedure, and mortality.

Statistical analysis

Descriptive statistics were used to summarize the results. Frequency and percentage were applied for qualitative variables, while measures of central tendency and dispersion were used for quantitative variables. Odds ratios (ORs) were calculated to measure associations, and the strength of association for unrelated dichotomous qualitative variables related to complications was assessed using the X^2 test, with a 95% confidence interval (CI) and statistical significance set at ≤ 0.05. All analyses were conducted using Statistical Package for Social Sciences version 26.0 for Windows.

RESULTS

The results are presented in tables and graphs to support the development of a medical specialty thesis in geriatrics and contribute to the publication of a scientific article.

Demographic characteristics

In this study, 294 patients who met the inclusion criteria and underwent cardiac catheterization were enrolled. The mean age of the patients was 74 ± 4 years, with a recorded range of 70-90 years. Of these, 70% (204) were male. Regarding BMI distribution, 71 patients were classified as obese (24%), 131 as overweight (45%), and 92 as having normal BMI (31%) (Fig. 1).

Comorbidities

Hypertension was the most prevalent condition, affecting 237 patients (81%): 26% of the obese group, 44% of the overweight group, and 30% of the normal BMI group. Diabetes mellitus was the second most common condition, recorded in 167 patients, with the overweight group being the most affected (39%). Dyslipidemia ranked third, with 35 patients, 46% of whom were overweight (Table 1).

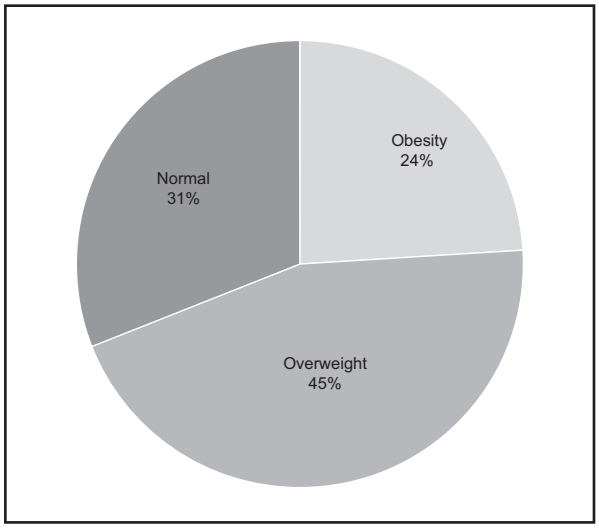

Figure 1. *Distribution of 294 older adult patients subjected to cardiac catheterization according to body mass index.*

Weight and angina duration

The mean weight of the obese group was 85 ± 11 kg, 74 ± 8 kg in the overweight group, and 62 ± 9 kg in the normal BMI group. The duration of angina before admission was 2 ± 4 years for obese patients, 3 ± 6 years for overweight patients, and 3 ± 5 years for patients with normal BMI.

Hospital stay and angina severity

The length of hospital stay was 3 ± 2 days in the obese group and 3 ± 3 days in both the overweight and normal BMI groups (Table 1). The severity of angina was categorized into four groups according to ESC guidelines[15]. The overweight group predominated in the strenuous effort category (52%), followed by the moderate effort category (43%), and the mild effort angina category (36%).

Complications

An average of 2 ± 1 complications was observed in the obese and overweight groups, compared to 3 ± 2 in the normal BMI group. In the obese and

Table 1. General characteristics of 294 patients undergoing cardiac catheterization

General characteristics	Obesity (n = 71) (%)	Overweight (n = 131) (%)	Normal (n = 92) (%)
Age (mean) ± SD	74 ± 4	75 ± 4	75 ± 4
Males (n = 204)	48 (68)	94 (72)	62 (67)
Weight mean ± SD	85 ± 11	74 ± 8	62 ± 9
Height mean ± SD	1.6 ± 0.1	1.7 ± 0.1	1.6 ± 0.1
Angina duration mean ± SD	2 ± 4	3 ± 6	3 ± 5
Angina type			
Only exertion	8 (11)	15 (11)	6 (7)
Moderate exertion	36 (50)	65 (50)	50 (54)
Mild exertion	25 (35)	47 (36)	31 (34)
At rest	2 (3)	4 (3)	5 (5)
Length of stay mean ± SD	3 ± 2	3 ± 3	3 ± 3
Hypertension	60 (85)	105 (80)	72 (78)
Dyslipidemia	11 (16)	16 (12)	8 (9)
Type 2 diabetes mellitus	48 (68)	66 (50)	53 (58)
Active smoker	2 (3)	3 (2)	4 (4)
Chronic kidney disease	10 (14)	7 (5)	5 (5)
Hypothyroidism	3 (4)	6 (5)	1 (1)
Heart failure	7 (10)	16 (12)	11 (12)

SD: standard deviation.

overweight groups, complications during PCI occurred in 14% of cases. These included failure to restore flow (20 patients), acute myocardial infarction (2 patients), arterial dissection (6 patients), cardiogenic shock (1 patient), and vascular access-related complications (1 patient). No complications were reported in 85% of these groups. Conversely, in the normal BMI group, complications during PCI occurred in 35% of cases, including failure to restore flow (18 patients), cardiogenic shock (1 patient), heart failure (2 patients), acute myocardial infarction (3 patients), and arterial dissection (8 patients). Four patients experienced vascular access-related complications, and one patient experienced arterial thrombosis post-PCI. In-hospital mortality occurred in one patient from this group (Table 2).

Association analysis

Compared to individuals with normal weight, overweight and obese patients showed a significantly lower risk of complications, with an OR = 0.24 (95% CI: 0.14-0.43; $p < 0.001$) (Table 3).

DISCUSSION

Globally, the World Health Organization reported an approximate prevalence of overweight (39%) and obesity (13%) by 2022. Nationally, three-quarters of adults are affected by these conditions. The ENSANUT 2018-19 highlights a prevalence of obesity and overweight of 76.3% in women and 73% in men, respectively. In Nuevo León, these figures reach 77.2% for men and 74.3% for women. In this study, obesity was present in 24% and overweight in 45%, lower than national averages but still a significant proportion of the population[7,8,16-17].

Regarding international studies such as CRUSADE, PURSUIT, CURA, and SYNERGY, the general characteristics of populations undergoing PCI align with this study's findings: most subjects were male, confirming that PCI is more frequently performed in men[18]. In addition, the average intervention age of 65 years in international records underscores the importance of studying factors in individuals aged over 75, as done in this research[5].

Hypertension was the most prevalent comorbidity in this study and in international literature, followed by diabetes mellitus and dyslipidemia, conditions associated with high cardiovascular risk[18,19]. Complications following PCI show variations across studies. For instance, the U.S. National Cardiovascular Data Registry reports a 4.53% prevalence of complications, primarily hemorrhagic events, cardiogenic shock, and cerebrovascular incidents. Conversely, this

Table 2. In-hospital complications of patients undergoing cardiac catheterization

Variables	Obesity and overweight (n = 202) n (%)	Normal (n = 92) n (%)
Average number of complications ± SD	2 ± 1	3 ± 2
Total complications	30 (15)	38 (41)
Complication during PCI	29 (14)	32 (35)
Cardiogenic shock	1 (0.5)	1 (1)
Cardiac failure	0	2 (2)
Cardiac tamponade	0	0
Acute myocardial infarction	2 (1)	3 (3)
Dissection of treated arteries	6 (3)	8 (9)
Coronary perforation	0	0
No-flow phenomenon	20 (10)	18 (20)
Endoprosthesis thrombosis	0	0
After 72 h	1 (0.5)	1 (1)
Contrast-induced nephropathy[a]	0	0
Cerebrovascular accident	0	1 (1)
Vascular access site infection	1 (0.5)	0
Vascular access-related complications	0	4 (4)
Hematoma	0	2 (2)
Hemorrhage[b]	0	0
Pseudoaneurysm	0	0
Arteriovenous fistula	0	0
Arterial thrombosis	0	1 (1)
Peripheral ischemia[c]	0	0
Mortality	1 (0.5)	1 (1)
None	172 (85)	54 (59)

[a]Requiring dialysis; [b]With hemoglobin levels below 7 mg/dL; [c]Of intervened limb. SD: standard deviation; PCI: percutaneous coronary intervention.

Table 3. Risk estimation of complications in overweight and obese patients undergoing cardiac catheterization

Variables	Obesity and overweight (n = 202) n (%)	Normal BMI (n = 92) n (%)	p	OR (95% IC)
Dissection of treated arteries	6 (3)	8 (9)	0.041	0.32 (0.11-0.95)
Failure to re-establish flow	20 (10)	18 (20)	0.026	0.45 (0.23-0.90)
Total complications	30 (15)	38 (41)	< 0.001	0.24 (0.14-0.43)

BMI: body mass index.

study found a 23% complication rate, predominantly failure to restore flow, acute myocardial infarction, and arterial dissection. These discrepancies may stem from differences in follow-up durations and complication recording practices[5].

Patients with normal BMI experienced more complications (3 ± 2) than overweight or obese groups (2 ± 1). These findings are consistent with Li Yi-Hwei et al.,[7] who identified overweight and obesity as protective factors against mortality (RR: 0.62, 95%

CI: 0.49-0.79; and RR: 0.52, 95% CI: 0.39-0.68, respectively). Although obesity and overweight pose cardiovascular risks, patients with normal BMI are not exempt from significant complications. This paradox may relate to malnutrition-inflammation syndrome or the endotoxin-lipoprotein hypothesis, among other factors[7,8].

Gruberg et al.[19] reported higher 1-year mortality rates in patients with normal BMI undergoing PCI ($p < 0.01$), aligning with this study's finding that all in-hospital mortality cases occurred in the normal BMI group. Similarly, multivariate regression revealed BMI (OR = 0.96, 95% CI: 0.94-0.98; $p = 0.0003$) as an independent predictor of long-term mortality. This contrasts with Younge et al.[20], who associated overweight, but not obesity, with lower all-cause mortality post-PCI (HR = 0.60, 95% CI: 0.42-0.86; $p = 0.005$).

This study highlights the complexity of BMI's relationship with post-catheterization complications in older patients. These findings may inform clinical guidelines, promoting tailored management for this population to enhance outcomes and reduce hospital burdens. Further research is necessary to elucidate the obesity paradox's mechanisms and its implications for post-catheterization outcomes.

Study limitations

This study's reliance on BMI as a nutritional assessment tool is a limitation, as BMI does not distinguish fat mass from lean mass or account for body fat distribution. Variations in age, sex, and ethnicity further limit its clinical utility. Future research should integrate additional anthropometric and clinical measures to provide a comprehensive health evaluation. Moreover, as this was not a prospective study, causality cannot be established, limiting conclusions about direct variable interactions.

CONCLUSION

This study provides valuable insights into the relationship between BMI and complications in patients over 70 years of age undergoing elective catheterization. The findings reveal that overweight and obese patients had a significantly lower prevalence of complications compared to those with normal weight, supporting the existence of the obesity paradox in this population.

Future research should focus on developing and validating more comprehensive assessment methods to address the limitations of BMI, particularly in elderly populations with complex clinical profiles. In addition, further studies are needed to elucidate the pathophysiological mechanisms underlying the obesity paradox and its impact on post-catheterization complications in this demographic.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

ETHICAL CONSIDERATIONS

Protection of humans and animals. The authors declare that no experiments involving humans or animals were conducted for this research.

Confidentiality, informed consent, and ethical approval. The study does not involve patient personal data nor requires ethical approval. The SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The authors declare that no generative artificial intelligence was used in the writing of this manuscript.

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