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Relationship Between Pain and Frailty in Obese Community-Dwelling Elderly Subjects: A Cross-Sectional Study

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Abstract

Background: Evidence suggests that chronic pain could be a trigger for frailty onset in the elderly, especially in those with other risk factors such as obesity. Both pain and obesity reduce physical activity, favouring muscle loss and functional impairment.

Objective: To determine the prevalence of moderate to severe pain in obese community-dwelling elderly patients and to assess the link with frailty status.

Methods and Design: An observational and cross-sectional study. Population is Obese (body mass index (BMI) >30) community-dwelling elderly subjects aged 65-75 years. Frailty status (robust, pre-frail or frail) was established according to Fried criteria. Pain was assessed using a visual analogue scale and was rated as moderate or severe when ≥ 3.

Results: Overall, 305 subjects were recruited (mean age 69.7 (2.7), 65.9% women). Prevalence of moderate to severe pain was 76.4% overall and 62.7%, 84.4% and 100% in robust, pre-frail and frail subjects, respectively ($p<0.001$). Mean pain was 5.3 (SD 3.3) overall and 3.9, 6.1 and 7.8 in robust, pre-frail and frail subjects, respectively ($p<0.001$). Moderate to severe pain was also associated with the female sex, BMI, arthritis, depression and functional performance. Multivariate analysis showed an independent association of pain with pre-frailty or frailty when adjusted for possible confounders.

Conclusion: Pain is associated with frailty, independently of age, sex, BMI, comorbidities and functionality, suggesting that pain control could be an effective measure in preventing frailty.

Keywords: Pain; Frailty; Obesity; Aged; Functional capacity

Introduction

Frailty is a geriatric syndrome characterized by a decrease in the organism's reserves and ability to respond to external aggressions. The functional decline of different organs and systems results in increased vulnerability to diseases, disability, adverse health outcomes and even death [1]. Frailty is usually accompanied by fatigue, little physical activity, loss of strength, slow gait speed and weight loss, all of which define the frailty phenotype [2]. Frailty is a dynamic condition; although it can evolve, it is also potentially reversible [3]. The prevalence of frailty in community-dwelling people aged 65 years and older has been estimated at approximately 11%. Prevalence increases with age and may be as high as 50% in the population aged over 80 years old [4]. With population ageing, this prevalence is expected to increase in the coming years.

The causes of frailty are not well established and its pathophysiology is not completely known. It is recognized as a multifactorial process that is influenced by different physiological changes that appear with age, as well as by the presence of comorbidities such as diabetes, stroke, depression or dementia. While some authors have suggested that pain may be a trigger for frailty onset [5], due to limitations imposed on physical activity and the consequent loss of muscle mass, this relationship has not been studied in depth. Cross-sectional and prospective studies have shown that obesity in community-dwelling elderly people is associated with a greater degree of fatigue, poor physical activity, loss of muscle strength and an increased risk of developing frailty [6-8]. The negative relationship between obesity and muscular strength is attributed to poor physical activity and muscle fat infiltration. However, the mechanisms by which obesity can enhance frailty are not well known but may include the release of pro-inflammatory cytokines with catabolic and anorexic effects, insulin resistance and an increased risk of type 2 diabetes mellitus with direct effects on the muscle, and an increased risk of osteoarthritis and pain [5,9] that limits physical activity, leading to muscular atrophy. We hypothesize that pain may play a role in developing frailty. The aim of this study was to determine the prevalence of moderate to severe pain in obese community-dwelling elderly patients, so as to identify the main factors associated with pain and to assess its independent relationship with frailty status.

Research Methodology

Study design and population

An observational cross-sectional study was designed in which community-dwelling elderly obese subjects were invited to participate. Study participants were recruited in 3 primary care centres in the city of Mataró (Barcelona, Spain) from February to May 2017. A sample of individuals aged 65-75 years of age, with a body mass index (BMI) of 30-40, was randomly pre-selected from the database of the 3 primary care centres participating in the study. Pre-selected subjects were invited by telephone to an appointment at the physician's office

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to confirm all selection criteria, to be informed about the study and to sign the consent form. Patients were excluded if they had active malignancy, neurodegenerative diseases, dementia or serious mental illness, hemiplegia, had a life expectancy of less than 6 months, were in a palliative care programme or were institutionalized. The study protocol was approved by the local ethics committee (code CEIC CSdM 23/16) and all participants gave their informed consent by writing before recruitment.

Data collection

The physical frailty phenotype was assessed using the criteria proposed and validated by Fried (Fried 2001):

- Unintentional weight loss of ≥4.5 kg in previous 12 months.
- Exhaustion, considered affirmative if the subject answered 3 days or more to either or both of 2 questions: "How often in the last week did you feel you could not get going?" and "How often in the last week did you feel that everything you did was an effort?.
- Low physical activity of less than 30 minutes outdoors walking a day.
- Walking speed of <0.75 m/sec; and (e) grip strength of <30 kg in men and <17 kg in women (measured by a handheld JAMAR dynamometer).

Persons were classified as follows: robust if they fulfilled none of criteria; pre-frail if they fulfilled 1 or 2 criteria; and frail if they fulfilled 3 or more criteria. Functional capacity was assessed by:

- The Barthel score (a validated and widely used questionnaire to assess the ability to perform activities of daily living), which ranges from 0 (null functional capacity) to 100 (optimal functional capacity).
- The timed up and go (TUG) test, which measures how long a person takes to get up from a chair, walk 3metres in a straight line and return to sit down.
- The 2-minute walking test, which measures the distance walked in 2 minutes (in metres). Weight and height were measured and BMI calculated as weight (in kilogrammes)/height^2 (in metres).

Pain was assessed using a 10-centimetre visual analogue scale (VAS); participants were asked to indicate their mean pain intensity in the previous month on a scale from 0, the complete absence of pain, to 10, the maximum imaginable pain. Pain was considered as moderate or severe when ≥3. Also assessed and recorded were sociodemographic data (age, sex and educational level), comorbidities, number of chronic medications and nutritional status (measured using the mini nutritional assessment -MNA- tool).

Statistical analysis

All data were recorded in an electronic database for scrubbing and analysis and pain prevalence (VAS ≥3) and 95% confidence interval (CI) values were calculated. Continuous variables were described using means and standard deviations and categorical variables were described using percentages. To evaluate variables associated with pain as an ordinal variable, the Mann-Whitney U test and Kruskal-Wallis test were used for binary variables and frailty status (3 categories), respectively, and Spearman's correlation coefficient (r_s) for numerical variables. To evaluate variables associated with pain as a categorical variable, the Chi square or Fisher exact test were used for categorical variables and the Mann-Whitney U test for numerical variables. Linear regression analysis was also used to assess the pain intensity relationship with different variables. Finally, odds ratios (OR) and their 95% CIs were calculated as a measure of association between different variables and frailty or pre-frailty using bivariate and multivariate logistic regression analysis. The stepwise method was used for the multivariate analyses; only considered were those variables that, in the bivariate analysis, were associated with both pain and frailty. Statistical significance was set at p<.05.

Results

Recruited were 305 participants: 201 women (65.9%) and 104 men (34.09%). Participants were aged 70.0 (2.8) years on average and presented a nearly optimal functional capacity (mean Barthel score 99.6 (1.6) points). BMI was <35 for 204 participants (66.9%) and ≥35 for 101 (33.1%) participants. Regarding frailty status, 118 (38.9%) participants were classified as robust, 179 (59.1%) as pre-frail and 6 (2%) as frail.

Variables	VAS Pain Mean (SD)	p-value	Patients with VAS pain ≥ 3	p-value
Arthritis				
Yes	6.14 (2.9)	<0.001	86.50%	<0.001
No	3.67 (3.4)		57.10%	
Ischaemic cardiopathy				
Yes	4.81 (3.9)	0.772	68.80%	0.544
No	5.31 (3.3)		76.60%	
Peripheral vasculopathy				
Yes	6.04 (3.0)	0.035	86.30%	0.022
No	5.05 (3.4)		73.30%	
Stroke				
Yes	6.09 (2.7)	0.547	90.90%	0.469
No	5.26 (2.7)		75.90%	
Depression				
Yes	6.36 (3.2)	<0.001	84.10%	0.088
No	4.97 (3.3)		74.20%	
Cancer				
Yes	6.57 (3.2)	0.206	85.70%	1
No	5.26 (3.3)		76.20%	
Chronic bronchitis				
Yes	4.03 (3.2)	0.008	64.10%	0.053
No	5.47 (3.3)		78.20%	
Asthma				
Yes	6.22 (3.1)	0.059	83.30%	0.296
No	5.16 (3.3)		75.50%	
Diabetes				
Yes	4.91 (3.5)	0.426	70.00%	0.117
No	5.42 (3.2)		78.70%	
Gastroduodenal ulcer				
Yes	4.71 (3.8)	0.61	64.70%	0.247
No	5.32 (3.3)		77.10%	
Hypertension				
Yes	5.43 (3.3)	0.115	77.20%	0.577
No	4.84 (3.3)		74.00%	
Dyslipidaemia				
Yes	5.20 (3.4)	0.58	74.50%	0.271
No	5.47 (3.3)		80.20%	
Unipedal test				
Able	5.08 (3.4)	0.009	73.90%	0.008
Unable	6.59 (2.3)		92.70%	
Outdoor activity				
Yes	5.25 (3.3)	0.289	76.30%	1
No	5.93 (3.7)		78.60%	
VAS: Visual Analogue Scale.				

Table 1: Co-morbidities and functional characteristics associated with pain.

Variables	Odds ratio	95% Confidence interval	p-value
Age (years)	1.04	0.94-1.14	0.445
Female sex	2.42	1.37-4.29	0.002
VAS pain	1.16	1.07-1.26	0.001
BMI (kg/m^2)	1.11	1.02-1.21	0.013
Arthritis	1.33	0.75-2.34	0.331
Depression	1.24	0.64-2.40	0.531
BMI: Body Mass Index; VAS: Visual Analogue Scale.			

Table 2: Variables associated with frailty or pre-frailty. Multivariate logistic regression analysis.

The prevalence of moderate to severe pain (VAS≥3) was 76.4% (95%CI: 71.6%-81.2%) overall, 84.1% (95%CI: 79.0%-89.2%) in women and 61.5% (95%CI: 52.1%-70.9%) in men (p<0.001). Mean VAS pain was 5.3 (3.3) points overall, 6.1 (3.0) in women and 3.6 (3.2) in men (p<0.001). The prevalence of moderate to severe pain was 73.5% (95%CI: 67.4%-79.6%) in participants with BMI<35 and 82.2% (95%CI: 78.4%-86.0%) in participants with BMI≥35 (p=0.094). Mean VAS pain was 4.9 (3.3) points in participants with BMI<35 and 6.0 (3.2) in participants with BMI≥35 (p=0.006). The prevalence of moderate to severe pain was 62.7% (95%CI: 54.0%-71.4%) in robust, 84.4% (95%CI: 79.1%-89.7%) in pre-frail, and 100% in frail subjects (p<0.001), and mean VAS pain was 3.9 (3.3), 6.1 (3.0) and 7.8 (2.2) (p<0.001) for robust, pre-frail and frail participants, respectively.

Pain intensity was correlated with BMI (r_s=0.15; p=0.007), number of medications (r_s=-0.37; p<0.001) and functional parameters such as the 2-minute walking test (r_s=-0.37; p<0.001), TUG test (r_s=0.29; p<0.001) and Barthel score (r_s=-0.14; p=0.018). Table 1 shows the main factors associated with pain. The multivariate lineal regression analysis, with VAS pain as the dependent variable, shows an independent relationship regarding pain for the female sex (β=1.32; p=0.001), frailty (β=1.21; p<0.001), arthritis (β=1.49; p<0.001) and the TUG test (β=0.19; p=0.001). Table 2 shows the effect of pain on frailty or pre-frailty when adjusted for possible confounders; for each additional point increase in the VAS, the risk of being frail or pre-frail increased by approximately 16%, independently of age, sex, BMI, arthritis or depression. No significant interactions were observed between pain and BMI (p=0.686) or between pain and depression (p=0.214) in terms of their effect on frailty (Tables 1 and 2).

Discussion

The main results of this study indicate that 3 in 4 obese community-dwelling elderly subjects (65-75 years old) suffer from significant pain and that, in this population, pain is related with frailty, independently of other characteristics such as sex, BMI, or depression. It is well recognized that pain is an extremely common symptom among the elderly population [10,11]. Pain prevalence has been estimated at 50% to 75%, although pain remains under diagnosed and undertreated in most cases. The pain prevalence observed in our study in elderly obese population corroborates the results of those other studies [10,11].

Obesity and pain are very common conditions among elderly people and both have been closely linked in cross-sectional studies and also in longitudinal studies, which indicate obesity as a risk factor for pain [12,13]. Obesity may cause pain because of mechanical stress or metabolic disruptions. Although more research is needed to elucidate the mechanisms by which obesity may cause pain, it has been strongly suggested that reducing obesity could reduce pain and its physical and emotional consequences. Chronic pain may be responsible for emotional conditions such as anxiety or depression. The prevalence of major depression in people aged 50 years and older has been estimated at 16% in western countries [14]. Some studies have shown that pain is a risk factor for depression [15,16], while other studies have shown that subjects with depression disorders are more likely to suffer from pain [17]. The results of these studies suggest that there could be a common neuro-inflammatory factor in the pathogenesis of both chronic pain and depression [18], but more studies are required to test this hypothesis. As in most population-based studies, our study reports pain and depression to also be associated with the female sex, which also shows higher frailty prevalence [4].

Regarding the relationship between pain and frailty, our study shows that frailty is associated with VAS pain as a numerical variable and also as a categorical one (≥3). We also observe that the greater the frailty, the greater the prevalence and intensity of pain. Moreover, this relationship is also observed when the effect of pain is adjusted for possible confounders such as age, sex, BMI, arthritis or depression. These results, which would suggest that pain may play a role in frailty development, corroborate other studies showing an association between pain and frailty performed in different settings and countries [19-23]. It has even been proposed to incorporate chronic pain in the measurement of phenotypic frailty and in predictions of adverse health outcomes [24].

The mechanisms by which pain may lead to frailty include a reduction in general physical activity and a decrease in the ability to walk and to move, as well as the emotional and social consequences of such physical impairments or limitations [3,5]. Physical inactivity fosters sarcopenia and muscle wasting and, ultimately, frailty. There is abundant evidence indicating that community-dwelling older adults with pain are more likely to fall [25], and fear of falling is well-known to discourage elderly people from going out and performing outdoor physical activities [26]. There is also strong evidence pointing to the relationship between falls and frailty [27].

Obesity is also a risk factor for falls and may enhance the effect of pain on frailty. Since pain is treatable and modifiable, it is also a potential target for interventions to prevent frailty. However, in our opinion the effect of pain on frailty must be further studied by prospective observational studies, as the therapeutic or preventive effect on frailty of treating pain is a hypothesis that requires confirmation by well-designed and suitably powered clinical trials. Nonetheless, the high prevalence of chronic pain in the elderly population, and especially in the obese population, requires urgent attention. Improving pain management in this population is an imperative that potentially has important emotional, physical and functional consequences for the patient, as well as for caregivers and the heath system.

The main limitations of the study include:

- Its cross-sectional design, which does not allow causal relationships to be established because of the temporal ambiguity between pain (the cause) and frailty (the effect), all measured in the same moment.
- The relatively small sample size and the low prevalence of frailty, which limits the statistical power of the study.
- The difficulty in evaluating a concept as subjective as pain, despite the fact that the VAS is a validated and widely used method for assessing pain in the elderly.

Conclusion

Pain is highly prevalent in obese elderly people and is associated with frailty and with other known risk factors for frailty such as sex,

BMI, arthritis and depression. While this study shows no interaction between pain and obesity or depression, it does show that pain is associated with frailty, independently of age, sex, BMI, arthritis, depression and functionality. These results suggest that pain plays a role in frailty onset and that pain control could therefore be an effective way to prevent frailty. However, this hypothesis needs to be confirmed by well-designed and suitably powered prospective studies and clinical trials.

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