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Original article

The prognostic value of body-mass index on mortality in older adults with dementia living in nursing homes

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SUMMARY

Background & aims: A protective effect of obesity on death has been reported in the context of various co-morbidities. We studied if the obesity paradox applied to nursing home (NH) older residents according to dementia status.

Methods: Prospective data from 3741 NH residents from France. All-cause mortality was the dependent measure. Subjects were categorized according with body mass index (BMI) as underweight, normal-weight, overweight, and obese. Dementia status was obtained from medical charts. Cox regressions were performed.

Results: There were 344 (9.2%) residents who were underweight, 1367 (43.8%) normal weight, 1069 (28.6%) overweight and 691 (18.5%) obese. 1083 (28.9%) people died during follow-up. In residents with dementia, mortality risk was reduced by almost half in overweight and obese people (HRs of 0.60 [0.48–0.76] and 0.53 [0.38–0.75], respectively; $p < 0.001$), and increased in underweight (HR = 1.65 [1.29–2.12]; $p < 0.001$) compared to normal-weight residents; moreover, each 1 kg/m^2 increase in BMI decreased the risk of death by 12% and 9% in underweight and normal-weight subjects with dementia. For people without dementia, mortality risk was reduced in overweight and obese people (HRs of 0.80 [0.65–0.99], $p = 0.042$, and 0.77 [0.60–0.99], $p = 0.044$, respectively) compared to normal-weight; the 1-unit increase in BMI reduced the risk of death (23% reduction) only in underweight people.

Conclusions: This study showed that the presence of dementia amplifies the obesity paradox in very old and functionally limited NH residents. Therefore, weight loss in NH residents, particularly in people with dementia, should be considered with extreme caution even for obese people.

1. Introduction

Obesity, often defined using the measurement of the body-mass index (BMI), is commonly associated with an increased risk for all-cause death [1,2]. However, this effect is reversed in certain clinical conditions. Compared to people with a normal BMI, the risk of all-cause death in subjects aged 65 years or over was observed to be lower in those with a high BMI [3–8] and higher in those with a low BMI [2,9–11]. This phenomenon is called the “obesity paradox”.

Dementia is a condition associated with weight loss and a low BMI [12]. It is also a risk factor for death [13]. Although a few studies [14,15] investigated the association of BMI with mortality in people with dementia (PWD), suggesting that the obesity paradox applies to this population, to our knowledge no study investigated the obesity paradox according to dementia status in the very old and vulnerable population of nursing home (NH) residents. The objective of this work was to compare the risk of all-cause mortality in PWD and in people with no dementia (PWND) according to their BMI in a large sample of NH residents.

2. Materials and methods

This work used the prospective data from the IQUARE study, previously described [16]. Briefly, IQUARE was a 6-month

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intervention, with a 18-month follow-up, multicenter individually-tailored non-randomized controlled trial designed to improve NH quality indicators in NHs from Midi-Pyrénées, Southwestern France (trial registration number: NCT01703689). In IQUARE, NHs were allocated to one of the following two groups: (a) audit and feedback intervention on NH quality indicators combined with cooperative work meetings between hospital geriatricians and NH staff, or (b) audit and feedback only. IQUARE followed the principles of the Declaration of Helsinki and complied with ethical standards in France; the study protocol was approved by the ethics committee of the Toulouse University Hospital and the Consultative Committee for the Treatment of Research Information on Health (CNIL 07-438).

3. Participants

A total of 6275 residents from 175 NHs participated in IQUARE. People were randomly selected (except for NH that had ≤30 potential participants, in which case all residents were included in the study) according to alphabetical order within each NH. There was no information on weight or height in 2107 subjects. In addition, 427 residents were lost to follow-up (280 had no follow-up data collection, and 147 changed from a NH to another NH or went back home). Our study population is therefore composed of 3741 subjects (mean age 85.9 ± 8.3 years; 73.7% women). The 2107 people without information on weight and/or height did not differ from the 3741 participants of this study regarding age ($p = 0.36$), sex ($p = 0.95$), the prevalence of dementia ($p = 0.86$), or co-morbidity index (0.68). The 427 subjects lost to follow-up did not differ from the 3741 participants included in this study for BMI categories ($p = 0.78$) or continuous BMI ($p = 0.61$).

4. Procedures

Data were collected online through two different questionnaires: a questionnaire about the NH structure and internal organization was completed by the NH administrative staff; and another questionnaire on residents' health status was completed by the NH medical staff, mainly the NH coordinating physician. Subject-related variables (except for medications) were obtained from the patients' medical records and were reported by the NH medical staff (including regarding participants' height and weight, dementia status, and date of death); for medications, the NH staff sent to the IQUARE research team all the resident's drug prescriptions prescribed during the week in which the residents were included in the study.

5. Outcomes

All-cause mortality over the study duration was the dependent measure. Surviving participants were censored at the last wave of data collection.

6. Independent variables of interest

Body-mass index: BMI was calculated from weight in kilograms divided by height in meters squared, and was categorized according to the World Health Organization thresholds [17] as underweight (BMI < 18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), and obesity (BMI ≥30.0).

Dementia: Residents with dementia were residents with a formal diagnosis of dementia as reported in the resident's medical chart; information on dementia severity or subtype was not available. Residents without dementia were residents with no formal diagnosis of dementia recorded in the medical chart.

7. Confounders

The analyses were controlled by taking into account a number of relevant variables. Subject-related variables were age (years), gender, modified Charlson Comorbidity Index (without dementia) [18], disability in activities of daily living (ADL, 6-item scale, with scores varying from 0 to 6 [higher scores indicating higher functional ability]. The 6 activities evaluated in this scale are: bathing, dressing, feeding, transferring, walking inside home, and continence), disability in walking outdoors (categories: fully independent, partially dependent, fully dependent), weight changes of ≥2.5% and ≥ 1 kg in the last two months [19,20] (categories: no change, weight loss, weight gain), number of medications (excluding antipsychotics), the study group to which the NH had been allocated in IQUARE, and the following dichotomous (yes vs. no) variables: hospitalization within the last 12-months, living in a special care unit (ie., living in a protective environment within the NH specifically designed and developed to take care of PWD during day-time and/or day- and night-time, and characterized by the elaboration of specific healthcare plans and social activities for PWD), presence of dietician within the NH, and use of antipsychotics.

8. Statistical analysis

Participants' characteristics were reported as median (25th to 75th percentiles) (discrete variables) and percentage (categorical variables); differences across BMI categories were tested using the Kruskal–Wallis test and the Chi-square test, as appropriate. Kaplan–Meier survival plots of mortality and log-rank test were performed for BMI categories in PWD and PWND separately. Cox regressions adjusted for all the confounders were performed to assess the effect of BMI categories on death according to the presence or absence of dementia. Three sensitivity analyses were performed by running Cox regressions. In the first sensitivity analysis, participants in whom the date of death was unknown were taken into account by using the mean of time found in all other participants. The second sensitivity analysis was performed by coding people with no formal diagnosis of dementia in the medical chart but for whom NH medical staff subjectively estimated ($n = 410$), on the basis of their knowledge about the resident, they potentially had dementia, in the dementia group (the dichotomous question used for defining this latter category was "Do you believe this resident has dementia?"). In the third sensitivity analysis, we recoded the BMI categories "underweight" and "normal-weight"; BMI categories for this sensitivity analysis were: underweight (BMI < 21), normal-weight (BMI 21–24.9), overweight (BMI 25.0–29.9), and obesity (BMI ≥30.0). Exploratory analyses within BMI categories were performed using BMI linear splines to investigate the association of 1 kg/m^2 increase in BMI with mortality (separately for PWD and PWND). Analyses were performed using Stata version 11 (StataCorp, College Station, TX).

9. Results

Among the 3741 participants, 1083 (28.9%) died during follow-up (mean follow-up period was 18.8 months); the date of death was unknown in 19 residents. There were 344 (9.2%) residents who were underweight (they were 857 residents (22.9%) when using underweight cut-off of BMI < 21), 1367 (43.8%) normal weight (they were 1124 residents (30%) when using normal-weight cut-off of 21 ≤ BMI < 25), 1069 (28.6%) overweight, and 691 (18.5%) obese. Table 1 presents participants' characteristics according with BMI categories. Overall, participants were very old and functionally

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