Archives of Gerontology and Geriatrics 76 (2018) 106–113

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Interaction between frailty and nutritional status on mortality and long-term hospitalization in older Koreans: A retrospective analysis of data from the 2008 Survey on Health and Welfare Status of the Elderly in Korea

Yu-Ri Choe[a], Ju-Youn Joh[a], Duk Sunwoo[b], Yeon-Pyo Kim[a,c,*]

[a] Department of Family Medicine, Chonnam National University Hwasun Hospital, Hwasun, South Korea
[b] Korea Institute of Health and Social Affairs, Sejong, South Korea
[c] Department of Family Medicine, Chonnam National University School of Medicine, Gwangju, South Korea

ARTICLE INFO

Keywords:
Frailty
Nutritional status
Interaction
Korean

ABSTRACT

Objectives: Although it is well known that nutritional deficiency influences frailty, and both nutritional status and frailty are closely related to mortality and morbidity in older people, there are no studies concerning this interaction. In this study, we evaluated whether the interaction of frailty and nutritional deficiency is additive and/or multiplicative.

Methods: We analyzed data from 8907 individuals (≥65 years old) who took part in the 2008 Survey on Health and Welfare Status of the Elderly in Korea. We used the Cardiovascular Health Study (CHS) frailty index and the DETERMINE checklist for assessment of frailty and nutritional status, respectively. We conducted Cox regression analysis for the outcomes 'mortality' and 'mortality and long-term hospitalization risk.'

Results: In the multivariate analysis for main effect model on 'mortality', the hazard ratios (HRs) of frail, high nutritional risk were 2.63 (95% CI 1.76–3.93), 1.04 (95% CI 0.78–1.38), respectively, and on 'mortality and long-term hospitalization risk' those values were 2.56 (95% CI 1.72–3.80), 1.18 (95% CI 0.88–1.58), respectively. In interaction effect model, multiplicative interaction existed between frailty and nutritional status ($p < 0.001$). Participants with frail X high nutritional risk had much higher HRs for 'mortality' (4.14, 95% CI 2.43–7.07) and 'mortality and long-term hospitalization risk' (4.60, 95% CI 2.74–7.72).

Conclusion: We found that frailty and nutritional status have a multiplicative effect on adverse outcomes in community-dwelling older adults. Nutritional status assessment in older people is important because nutritional supplementation can potentially improve both nutritional status and frailty.

1. Introduction

The elderly population is increasing rapidly worldwide; the number of people aged 65 and over was 461 million in 2004 and will be an estimated 2 billion by 2050 (Kinsella & Phillips, 2005). South Korea also has shown a rapid increase in the percentage of its population aged 65 and over, from 7.2% of the total population in 2000 to 11% in 2010. This increase is expected to continue to 20.8% by 2026 (Korea Institute for Health & Social Affairs, 2008; Statistics Korea, 2006).

As a population ages, frailty and malnutrition become more pronounced (Clegg, Young, Iliffe, Rikkert, & Rockwood, 2013). The most common definition of frailty is 'a state of decreased functional reserve and resistance to stressors due to dysregulation of multiple physiological systems' (Clegg et al., 2013; Rodriguez-Manas et al., 2013; Fried et al., 2001). In many previous studies, frailty has been shown to increase the risk of adverse outcomes, such as poor functional and cognitive status, falls, the need for long-term hospital care, and mortality (Graham et al., 2009; Joosten, Demuynck, Detroyer, & Milisen, 2014; Rockwood et al., 2004; Ensrud et al., 2007). The 'phenotype of frailty' defined by Fried and colleagues is widely used and validated by many other studies (Fried et al., 2001; Rockwood et al., 2004; Bandeen-Roche et al., 2006). Nutritional status is also an important factor that

Abbreviations: CHS, Cardiovascular Health Study; MNA, Mini Nutritional Assessment; DM, Diabetes Mellitus; CVD, Cerebrovascular Disease; IHD, Ischemic Heart Disease; CKD, Chronic Kidney Disease; MMSE-KC, Mini-Mental State Examination in the Korean version of the Consortium to Establish a Registry for Alzheimer's Disease; CERAD, Consortium to Establish a Registry for Alzheimer's Disease; SD, Standard Deviation; HR, Hazard Ratio; CI, Confidence Interval; BMI, Body Mass Index; CES-D, Center for Epidemiologic Studies Depression; IPAQ, International Physical Activity Questionnaire

* Corresponding author at: Department of Family Medicine, Chonnam National University Hwasun Hospital, 322 Seoyang-ro, Hwasun-eup, Hwasun-gun, Chonnam, South Korea/ Chonnam National University School of Medicine, 160 Baekseo-ro, Dong-gu, Gwangju, South Korea.
E-mail addresses: hiyuriya@naver.com (Y.-R. Choe), hoya419@hanmail.net (J.-Y. Joh), duksw@kihasa.re.kr (D. Sunwoo), ypkim@jnu.ac.kr (Y.-P. Kim).

https://doi.org/10.1016/j.archger.2018.01.011
Received 7 July 2016; Received in revised form 14 December 2017; Accepted 27 January 2018
Available online 09 February 2018
0167-4943/

influences prognosis in older adults. Several past studies found that malnourished older people have higher morbidity, mortality, and cognitive impairment, and a more difficult recovery from their functional deficits (Soderstrom, Rosenblad, Adolfsson, Saletti, & Bergkvist, 2014; Beck, Ovesen, & Osler, 1999; Donini et al., 2011; Correia & Waitzberg, 2003). Furthermore, many studies have reported the influence of low caloric and protein intake on geriatric frailty (Bartali et al., 2006; Bollwein et al., 2013; Leon-Munoz, Garcia-Esquinas, Lopez-Garcia, Banegas, & Rodriguez-Artalejo, 2015; Smit, Winters-Stone, Loprinzi, Tang, & Crespo, 2013).

Because nutritional status affects geriatric frailty, and both nutritional status and frailty are closely related to elder mortality and morbidity, we hypothesized potential interaction between these two factors. In this study, we evaluated whether the interaction between frailty and nutritional status influences clinical outcomes in older people in an additive and/or multiplicative manner.

2. Methods

2.1. Materials and participants

In Korea, the Survey on Health and Welfare Status of the Elderly (Elderly Survey) is conducted every three years by the Korean Ministry of Health and Welfare to obtain accurate data and information for health and welfare policies related to the elderly. Data used in this study were acquired from the Survey on Health and Welfare Status of the Elderly in 2008 in Korea (Elderly Survey 2008), which surveyed adults aged 60 years or older between August 11, 2008 and January 10, 2009.

A total of 15,146 elderly people completed the Elderly Survey 2008. We analyzed data from individuals aged 65 years or older that completed the assessment about frailty and nutritional status (n = 8907).

A follow-up survey was conducted in 2011 (Elderly Survey 2011). Of the 8907 participants from the Elderly Survey 2008, there were 6147 individuals who survived and completed the follow-up survey and 2113 individuals who survived but could not be contacted due to various reasons (arriving home late, long-term trips, refusal to take the survey, or having moved). Relatives or neighbors provided explanations for 647 individuals who could not complete the follow-up survey; 511 were identified as deceased and 40 were identified as long-term hospitalized (Fig. 1).

The Elderly Survey data are nationally representative and publicly available. The study protocol was approved by the Chonnam National University Hwasun Hospital Institutional Review Board (CNUHH-EXP-2015-125).

2.2. Frailty

We used the definition of frailty developed by Fried and colleagues (Fried et al., 2001). The Cardiovascular Health Study (CHS) frailty index has been widely used and validated by many studies of the elderly population (Graham et al., 2009; Joosten et al., 2014; Rockwood et al., 2004).

Frailty was assessed with a 5-item scale (weight loss, exhaustion, walking speed, physical activity, and grip strength), where each item was scored with a 0 or 1, with a possible maximum score of 5 (Ensrud et al., 2007; Kiely, Cupples, & Lipsitz, 2009). We evaluated weight loss and exhaustion through self-assessment questionnaires. Unintentional weight loss more than 4.5 kg (or 5% of the body weight) was given 1 point. One point was given if the respondent answered 'moderate amount or most of the time over the previous week' on either questions; 'I felt that everything I did was an effort' and 'I could not get going.' To measure walking speed, the participants were asked to walk 8 feet at a comfortable speed. The time they spent walking was measured twice, and the shorter time was selected. Physical activity was measured using the International Physical Activity Questionnaire (IPAQ) (Booth et al., 2003). By using self-assessment questionnaires, we identified the amount of physical activity (minutes of activity per event × events per week) based on the level of intensity (walking (3.3 METs), moderate intensity (4.0 METs), vigorous intensity (8.0 METs)). We used the IPAQ scoring protocol and determined the continuous score (expressed as MET-minutes per week: MET level × min of activity × events per week). Grip strength was measured using a dynamometer (Hand Grip Meter No. 6103, Tanita, Tokyo, Japan). Each participant was asked to grip the dynamometer twice with both arms in a lowered and straight position, and the highest value was used for analysis. If the values for walking speed, physical activity, or grip strength fell in the lowest 20th percentile, 1 point was given for each. The total frailty score was determined by the sum of the five items. Participants receiving a score of 0 were classified as robust, 1–2 as pre-frail, and 3–5 as frail. We followed the guidelines and slightly modified the procedures established by Fried et al. We used cut-off values for statistical significance obtained by reanalyzing data of the Elderly Survey 2008 (Table 1) (Ministry of Health & Welfare, 2009).

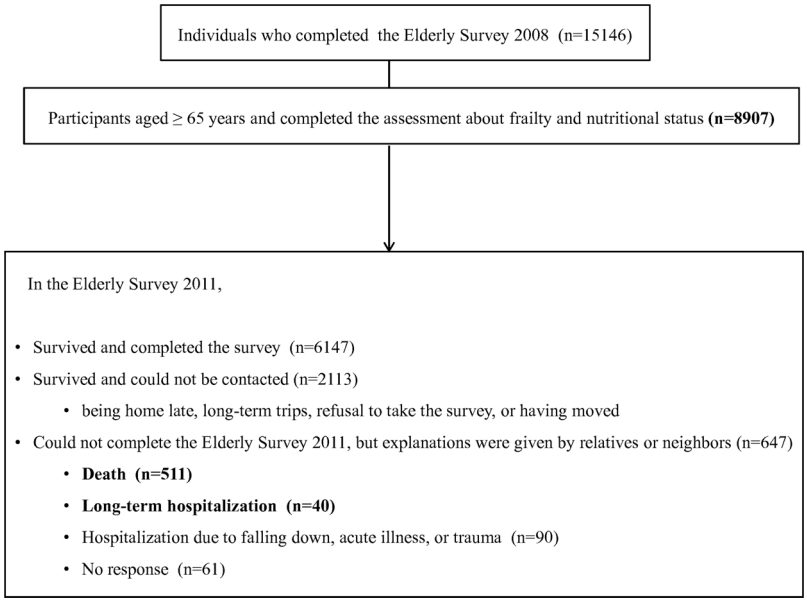

Fig. 1. Study participant selection process.