Preventive Medicine 67 (2014) 28–34

Contents lists available at ScienceDirect

Preventive Medicine

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

Cognitive impairment assessed at annual geriatric health examinations predicts mortality among the elderly

Chen-Yi Wu [a,b], Yi-Chang Chou [a,c], Nicole Huang [c,d], Yiing-Jenq Chou [a], Hsiao-Yun Hu [a,c,*], Chung-Pin Li [e,f,**]

[a] Institute of Public Health, National Yang Ming University, Taipei, Taiwan
[b] Department of Dermatology, Taipei City Hospital, Heping Fuyou Branch, Taipei, Taiwan
[c] Department of Education and Research, Taipei City Hospital, Taipei, Taiwan
[d] Institute of Hospital and Health Care Administration, National Yang-Ming University, Taipei, Taiwan
[e] Division of Gastroenterology, Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan
[f] National Yang-Ming University School of Medicine, Taipei, Taiwan

ARTICLE INFO

Article history:
28 March 2014
20 June 2014
22 June 2014
Available online 28 June 2014

Keywords:
Cognitive impairment
Mortality
Elderly
Short Portable Mental Status Questionnaire (SPMSQ)

ABSTRACT

Objective: To determine whether cognitive impairment assessed at annual geriatric health examinations is associated with increased mortality in the elderly.

Method: This cohort study was based on data obtained from the government-sponsored Annual Geriatric Health Examination Program for the elderly in Taipei City between 2006 and 2010. The study sample consisted of 77,541 community-dwelling Taipei citizens aged 65 years or older. The Short Portable Mental Status Questionnaire (SPMSQ) was selected to measure cognitive impairment. Mortality was ascertained by matching cohort IDs with national death files.

Results: There was a dose–response relationship between cognitive impairment and mortality (increased one score of SPMSQ, Hazard ratio [HR]: 1.12, 95% confidence interval [CI]: 1.10–1.14). Relative to no cognitive impairment, the HRs were 1.67 (95% CI: 1.43–1.94), 2.26 (95% CI: 1.90–2.70), and 2.68 (95% CI: 2.25–3.19) for mild, moderate, and severe cognitive impairments, respectively. The causes of death associated with cognitive impairment were circulatory, respiratory, and other causes, but not death from cancer.

Conclusion: Cognitive impairment as measured by the SPMSQ is associated with an increased risk for mortality. Even mild cognitive impairment was associated with greater risk of mortality at a relatively short follow-up time.

Introduction

Cognitive impairment is a major cause of morbidity and disability among older people, and constitutes one of the most serious and expensive challenges of the aging population. Its prevalence increases with age, with mild cognitive impairment having been reported to affect 20% of those aged 65 and older (Jia et al., 2014). Previous studies have consistently found that dementia is associated with increased mortality (Ganguli et al., 2005; Larson et al., 2004; Wilson et al., 2009; Wolfson et al., 2001). Although moderate-to-severe cognitive impairment has been identified as a risk factor for mortality among the elderly (Gale et al., 1996; Stump et al., 2001), research on the impact of mild cognitive impairment on mortality risk has produced conflicting results (Bassuk et al., 2000; Stump et al., 2001). Among those research investigating the relationship between cognitive impairment and mortality risk, they have been limited to small sample sizes, younger age groups, restrained access to data on health condition, restricted numbers of elderly with mild cognitive impairment, or focused on specialized settings of patients, such as primary care patients, nursing home residents, or dialysis patients (Griva et al., 2010; Magaziner et al., 2005; Nguyen et al., 2003; Stump et al., 2001). For those unique groups of patients in the specialized settings, mortality experiences may not be typical of the population of cognitively impaired who have been reported to have higher mortality rates (Dewey and Saz, 2001).

An extensive evaluation, including multiple neuropsychological tests or neuroimaging, is typically used to establish a formal diagnosis of dementia or Alzheimer's disease (Ganguli et al., 2005; Larson et al., 2004; Wilson et al., 2009). Other studies have used the Mini-Mental State Examination (MMSE) to evaluate cognitive impairment (Bassuk et al., 2000; Nguyen et al., 2003), but it is considered too long and too difficult to use as a screening tool. Stump et al. (2001) used the Short Portable Mental Status Questionnaire (SPMSQ) (Pfeiffer, 1975) to assess the impact of cognitive impairment on mortality in older primary care patients, and revealed that moderate-to-severe cognitive impairment was associated with an increased risk of mortality, while mild cognitive

* Correspondence to: H.-Y. Hu, Institute of Public Health, National Yang Ming University, No. 155, Sec. 2, Li-Nong St., Taipei 112, Taiwan. Fax: +886 2 2826 1002.
** Correspondence to: C.-P. Li, Division of Gastroenterology, Department of Medicine, Taipei Veterans General Hospital, No. 201, Sec. 2, Shih-Pai Road, Taipei 112, Taiwan. Fax: +886 2 2873 9318.
E-mail addresses: hyhu@ym.edu.tw (H.-Y. Hu), cpli@vghtpe.gov.tw (C.-P. Li).

http://dx.doi.org/10.1016/j.ypmed.2014.06.027
0091-7435/

impairment was not. Sachs et al. (2011) used the SPMSQ to screen for cognitive impairment and evaluate its association with mortality in patients from a primary care setting, and found it a useful tool to identify cognitive impairment. Due to low social awareness and importance of early intervention, there is an urgent need to evaluate the cognitive status of potentially healthy participants in the community.

In this study, we evaluated whether cognitive impairment, evaluated by a one-time administration of the SPMSQ, is associated with increased mortality in patients aged 65 years or older who receive healthcare services from the Annual Geriatric Health Examinations Program.

Methods

Study population

The data source for this study was the Taipei City Elderly Health Examination Database. The cohort consisted of 77,541 participants aged 65 years or older, including 39,365 men and 38,176 women. The participants were enrolled in the annual physical examination program for elderly people run by the Taipei City Government, between May 1, 2006 and December 31, 2010. Participants voluntarily took part in the physical examination program, and were encouraged to visit it on a yearly basis for a routine physical examination; however, only the results from the initial visit were used for analyses. Demographic information, including marital status, educational level, and lifestyle data and habits, such as smoking history, alcohol consumption, and exercise, were collected through a self-administered questionnaire. During the medical check-up, measurements of height, body weight, and blood pressure were taken, in addition to a blood sample for laboratory analyses. Data related to individuals' identification were encrypted before they were released to the researchers. The acquisition and processing of the data were approved by the institutional review board of Taipei City Hospital (IRB No.: TCHIRB-1020417-E).

Definition of cognitive impairment

The SPMSQ, a widely used 10-item cognitive screening instrument, was selected to measure cognitive impairment. This evaluation tool assesses an individual's orientation to time and place, memory, knowledge of current events, and calculation. The SPMSQ has been validated as a measure of cognitive function in the elderly in a Taiwanese population (Hsiao et al., 1994). In previous studies, the SPMSQ's validity and reliability have been established in detecting the absence or presence of dementia (Albert et al., 1991; Dalton et al., 1987; Erkinjuntti et al., 1987; Fillenbaum et al., 1998; White and Davis, 1990). The scoring system for the SPMSQ is as follows. A score with 0 to 2 errors indicates no cognitive impairment, 3 to 4 errors indicates mild impairment, 5 to 7 errors indicates moderate impairment, and a score with 8 to 10 errors indicates severe impairment. A cut-off point of 3 errors on the SPMSQ has been reported to be equated with a MMSE score of 23 (Hooijer et al., 1992). The SPMSQ results were not corrected for education because education was included as a covariate in our analyses.

Control variables

Baseline data were collected, including age, sex, marital status (single, married/cohabiting), educational level (none, 1–6 years, 7–12 years, >12 years), smoking (frequently, occasionally, none), alcohol consumption (frequently, occasionally, none), and physical activity (none, 1–2 times/week, 3–5 times/week). Height, weight, systolic blood pressure (SBP), and diastolic blood pressure (DBP) were measured. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. We used the World Health Organization (WHO) BMI categories for underweight (15–18.4 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), and obesity ($\geq$30 kg/m^2). Laboratory data including fasting blood sugar (FBS), triglycerides (TG), total cholesterol (TC), aspartate transaminase (AST), alanine transaminase (ALT), albumin, creatinine, blood urea nitrogen (BUN), and hemoglobin were measured. These measures of health are referred to as the clinical characteristics of the participants.

The 5-item Brief Symptom Rating Scale (BSRS-5) was used to screen for possible depression and anxiety. The BSRS-5, an effective instrument with five items, is used to screen for psychiatric morbidity in general medical patients and community residents (Lu et al., 2011; Lung and Lee, 2008). A total score on the BSRS-5 above 15 indicates a severe mood disorder. Scores between 10 and 14 indicate a moderate mood disorder, and those between 6 and 9 indicate a mild mood disorder. Participants who scored below 6 on the BSRS-5 were considered to have normal mood.

Outcome variables

The vital statistics of the 77,541 participants, as of December 31, 2010, were ascertained by matching cohort IDs with computerized national death files. Information on the cause of deaths was coded according to two versions of the International Classification of Diseases (ICD); for data between 2006 and 2008, we used the ninth revision (ICD-9; codes 001–998), while for data between 2009 and 2010, we used the tenth revision (ICD-10; codes A00–Z99). Deaths were coded as cause-specific deaths when they were due to cancer (codes 140–239 in ICD-9 and C00–D49 in ICD-10), circulatory (codes 390–459 in ICD-9 and I00–I99 in ICD-10), or respiratory causes (codes 460–519 in ICD-9 and J00–J99 in ICD-10). Deaths that were not due to cancer, circulatory, or respiratory causes were coded as “other”.

Statistical analyses

Trend analysis was used to examine the mean differences in clinical characteristics among the different levels of cognitive impairment. We calculated relative risks for mortality using the Cox proportional hazards model. The time of entry was the initial examination date (between May 1, 2006 and 2010), and the time of exit was the end of the follow-up period (December 31, 2010) or the date of death, if earlier. In the survival analysis of cognitive impairment and mortality risk, the survival curve was estimated by the Kaplan–Meier method, and the log rank test was used to determine the differences between groups. With the reference group consisting of persons without cognitive impairment, the hazard ratio (HR) for each category of impairment was calculated. Further subgroup analyses were performed to evaluate the mortality risk. HRs were calculated to examine the association between cognitive impairment and cause of death, controlling for demographics, socioeconomic data, lifestyle factors, and health status.

All analyses were conducted using the SAS 9.3 (SAS Institute Inc., Cary, NC) and STATA 10.0 (STATA Corp, College Station, TX) statistical software packages.

Results

The proportion of individuals in each category of cognitive impairment, the baseline characteristics of all participants, and the follow-up mortality of the cohort by level of cognitive impairment are shown in Table 1. There were 77,541 participants with a mean age of 73.1 (SD = 6.6) years. The five-year study period yielded 254,211 person-years of observation, with an average follow-up of 3.28 years (SD = 1.30). Those with the following characteristics were likely to present with greater cognitive impairment: female, single, low educational level, less regular exercise, underweight, and higher psychiatric morbidity.

The analyses of the participants' clinical characteristics for each level of cognitive impairment are presented in Table 2. Those with more severe cognitive impairment had lower FBS, DBP, TC, ALT, albumin, and hemoglobin, and higher AST, BUN, and creatinine levels.