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Pain is not associated with cognitive decline in older adults: A four-year longitudinal study

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ABSTRACT

The finding of a potential association between pain and cognitive decline is limited to a few cross-sectional studies with relatively samples. We therefore aimed to investigate whether the presence and severity of pain at baseline could predict a decline in cognitive function over four years of follow-up in the English Longitudinal Study of Ageing. At baseline, participants with no dementia who were "often troubled by pain" were considered to have pain. Pain severity was categorized as mild, moderate, or severe. Cognitive function was explored through verbal fluency (assessed by asking how many different animals the participants could name in 60 s), memory (sum of immediate and delayed verbal memory) and processing speed (number of target letters correctly identified on the letter cancellation task). Multivariable linear regression was used (exposure: pain; outcomes: cognitive change between follow-up and baseline, based on standardized residuals). Altogether, 6515 community-dwelling people with a mean age of 65 years (women = 57.3%) were included. Over a 4-year follow-up, after adjusting for 26 potential confounders, no association between pain (yes vs. no) and verbal fluency (beta = 0.02; 95%CI: −0.15 to 0.18), memory (0.05; 95%CI: −0.28 to 0.38), or processing speed (0.55; 95%CI: −18.4 to 2.93) at follow-up was found. Only severe pain was associated with greater decline in memory (−0.36; 95%CI: −0.68 to −0.04). In conclusion, in older people, pain was not associated with worsening in cognition, except for severe pain, which was marginally associated with worsening in memory tests. Further longitudinal studies are needed to confirm or refute our findings.

1. Introduction

Pain is a frequently reported symptom, with over half of older adults experiencing pain [1]. Pain is associated with a range of adverse outcomes in older age, including a deterioration of activities of daily living, physical and mobility disability [2,3], low physical activity [4], falls [5], fear of falling [6] and frailty [7,8]. It has been hypothesized that the increased risk of falls and subsequent mobility limitation in older people with pain may partly be attributed to impaired cognition [9–11].

Whilst research has started to consider the impact of pain on cognition in older age, it has been limited by small samples, cross-sectional designs, and a small number of tests assessing cognitive functioning [9–14]. Thus, it remains unclear whether pain is associated with various important subdomains of cognition. One recent study with a large

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cohort of American participants found that persistent pain was associated with a more rapid memory decline and with a moderate increase in the incidence of dementia compared with those without persistent pain [15]. Although this study helps advance our understanding of the link between pain and the onset of poor cognitive status, some important confounders known to influence cognition in older age (such as physical activity [16]) were not assessed. Moreover, only six comorbidities were included, and thus some important causes of pain and/or cognitive decline in the elderly were not considered [15]. Given the high levels of pain in older adults [17] and the need to identify potential modifiable risk factors for cognitive decline, it is important that robust longitudinal research considers this important question.

Given this background, we aimed to explore whether the presence of pain at baseline could predict any decline in performance on several cognitive tests assessed in the English Longitudinal Study of Ageing (ELSA), an ongoing cohort study of community-dwelling older people, over four years of follow-up. In a secondary analysis, we explored whether the severity of pain is associated with declines in performance on cognitive tests.

2. Materials and methods

2.1. The survey

The English Longitudinal Study of Ageing (ELSA) is a nationally representative longitudinal ongoing study of 11,050 people living in England aged 50 and over. The first assessment was conducted in 2002/3 with an extensive nurse visit every four years and a face-to-face interview every two years (http://www.elsa-project.ac.uk/). For the purposes of the present analyses, we used data from wave 2 (2004/2005) (baseline) and wave 4 (2008/2009), since these two waves included all the cognitive tests mentioned below.

Participants gave full informed consent to participate in the study and ethical approval was obtained from the London Multi-center Research Ethics Committee.

2.2. Exposure: pain

At baseline (wave 2), participants were asked if they were “often troubled by pain”. If they responded “no,” their response was coded as “no pain”. Those who responded affirmatively were asked to evaluate the intensity of their pain as mild, moderate or severe.

2.3. Outcome variables: changes in cognitive tests

Cognitive function was evaluated in the ELSA through several tests. For our research, we included three domains of cognition, namely verbal fluency, memory and processing speed [18]. Verbal fluency was assessed by asking how many different animals the participants could name in 60 s. Memory was calculated as the sum of immediate and delayed verbal memory. Specifically, to each participant, a list of 10 nouns was presented on a computer, one every 2 s. Participants were asked to recall as many words as possible immediately and again after a short delay during which they carried out the other cognitive tests. As a measure of processing speed, the score of the number of target letters correctly identified on the letter cancellation task was taken. Briefly, for this last task, participants were given a clipboard to which a page of 780 random letters of the alphabet set out in a grid of 26 rows and 30 columns was attached. The participant was asked to cross out as many target letters (P and W) as possible in 1 min. An example was given at the top of the page to show participants how to cross out the letters. Participants were asked to work across and down the page as if they were reading and to perform the task as quickly and accurately as possible.

To calculate the degree of cognitive change between wave 4 and 2, we carried out a linear regression analysis using the values of each test at wave 2 as independent variables, and scores of cognitive tests at wave 4 as dependent variables and using the standardized residual as a measure of cognitive change.

2.4. Other covariates

We considered several potential confounders in the association between pain and cognitive tests, other than age, sex, race: (1) education, descriptively reported as formal education (“some college” and “college and above”) vs. other (no education, high-school, high-school graduate); (2) marital status, categorized as married vs. others (not married, divorced, singles, not known); (3) smoking habits, categorized as current/former vs. never; (4) disability, categorized as having at least one difficulty in activities of daily living (ADL) vs. no difficulty; (5) body mass index (BMI), measured by a trained nurse; (6) self-reported physical activity, assessed by questions on the frequency of participation in vigorous, moderate and light physical activities (more than once per week, once per week, one to three times per month, hardly ever) and descriptively reported as high vs. other levels; (7) alcohol consumption, categorized as yes vs. no in the last week; (8) depressive symptoms, through an 8-item version of the CES-D [19]; (9) household wealth, calculated as total net non-pension household wealth, which is a summary measure of the value of financial, physical and housing wealth owned by the household (i.e., a single respondent or a responding couple along with any dependent individuals) minus any debt.

Medical conditions were defined according to whether participants were told by a doctor they had arthritis, osteoporosis, stroke, heart problems (heart attack, congestive heart failure, angina, acute myocardial infarction, arrhythmia), lung diseases (chronic lung disease or asthma), cancer, diabetes, high blood pressure/hypertension, or Parkinson’s disease. Information at baseline was used for all the above-mentioned covariates.

2.5. Statistical analyses

Normal distributions of continuous variables were tested using the Kolmogorov-Smirnov test. The data were normally distributed and therefore means ± standard deviations (SDs) were used to describe quantitative measures. Percentages were used for all discrete variables. For comparing descriptive characteristics by pain status (yes vs. no), continuous variables were compared using an independent Student’s test, whilst a chi-square test was used for categorical variables.

The strength of the association between pain at baseline and cognitive changes occurring between waves 2 and 4 was assessed through a linear regression analysis in two models, one adjusted only for age and sex (basic) and one adjusted for all baseline factors known to be associated with poor cognition and significantly different between people with pain and those without, taking a p-value < 0.10 as the inclusion criterion for both situations (fully adjusted multivariable model). Multicollinearity was assessed with the variance inflation factor (VIF), taking a cut-off of 2 for exclusion, but no covariate was excluded for this reason. The results were reported as betas with their 95% confidence intervals (CIs). We also reported the model’s fits as R^2.

In the secondary analyses, we assessed whether pain categorized according to its severity (i.e. mild, moderate, severe) could affect cognitive change using a linear regression analysis, reported as fully adjusted betas with 95% CIs.

We performed several sensitivity analyses using as potential moderators of our results the median values for continuous variables and the original division for categorical parameters. However, none of the interaction terms between pain and these potential moderators was significant in predicting performance on cognitive tests at follow-up (all p-values > 0.05).

All analyses were done using the SPSS 21.0 for Windows (SPSS Inc., Chicago, Illinois). All statistical analyses were two-tailed, and a p-value < 0.05 was assumed to be statistically significant.