Acute Pain and Cognition in Older Persons

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Abstract

Objectives: So far studies have focused on the relationship between cognitive impairment and chronic pain perception in elderly. The present study examined the relationship between acute pain perception and cognition.

Methods: Fifty-nine nursing home residents underwent a neuropsychological assessment aimed at cognition. Assessment of acute pain took place directly following a venipuncture, utilizing the Coloured Analogue Scale (CAS).

Results: Acute pain perception showed a negative relationship with the scores on the cognitive tasks. Other variables such as hypertension and medication usage did not seem to influence the relationship.

Discussion and Conclusion: The present findings imply that the more cognitive impairment a person experiences, the higher the acute pain experience is. This increases the risk for under treatment of pain.

Keywords: Acute pain • Cognition • Elderly

Introduction

The prevalence of elderly will steadily increase in the next decades [1-3]. As ageing increases the risk for painful conditions such as neck and shoulder pain [4-6] and is the highest risk factor for cognitive decline [7], an increasing number of cognitively impaired patients, suffering from pain, will be expected [8].

During the last two decades, the number of studies examining possible alterations in pain experience in cognitive impaired persons has increased considerably. In the majority of those studies, the focus was on chronic pain [9-11] e.g. arthritis/arthrosis [9]. The results of those studies suggest that the alteration in pain experience may depend on the neuropathology underlying the cognitive impairment. For example, aging causes atrophy in the brain [10-12], and white matter lesions [12], possible resulting in an alternation in the pain experience [11]. It has been suggested that, depending on the neuropathology, this may cause an increase or a decrease in pain experience [11]. More specifically, atrophy of e.g. the hippocampus may cause a decrease in pain experience [13]. On the other hand, white matter lesions may lead to an increased pain experience, due to de-afferentation [11]. White matter lesions may also impair cognitive functions [7]. Indeed, an increase in chronic pain experience has been observed in patients with ‘possible’ [11] and ‘probable’ vascular dementia [14,15]. The neuropathological hallmark of VaD are white matter lesions [16].

The clinical relevance of the here addressed results is that chronic pain in older persons who are less able to communicate about it, may remain unnoticed and, consequently, untreated [17]. Indeed, results of a number of studies suggest that cognitively impaired patients are at risk for under treatment of pain [18].

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Received 03 August, 2020; Accepted 28 July, 2020; Published 16 June, 2019

In the above mentioned studies, particularly chronic pain was examined. The question arises whether there is also a relationship between an alternation (either an increase or a decrease) in acute pain and the level of cognitive functioning in older persons.

Research Methodology

Subjects

The sample consisted of 59 participants (29 males and 30 females). All subjects were residents of a nursing home (St. Jacob) in Amsterdam.

Age

The age varied between 60 and 101 years, with a mean of 84.98 (SD = 8.46).

Comorbidities

The following comorbidities were listed: Heart, lungs, kidney-urinary, tumor, rheumatism, peripheral-artery, epilepsy, gall bladder, hypertension, diabetes, fractures, pancreatic, hernia, thyroid, bipolar, alcohol, TIA, stroke, psychiatric disorders (e.g. borderline), pneumonia-inflammations and anaemia.

Informed consent

All participants or their legal representatives signed an informed consent stating their voluntary participation in this study.

Materials and Procedures

The present study utilized several tests and questionnaires to assess participants’ cognitive functioning, mood and pain experience. The means, standard deviations and ranges are summarised in Table 1.

Cognition, Global cognitive functioning

Global cognitive functioning was assessed using the Mini Mental State Examination (MMSE) which provides a score of global cognitive functioning [19]. 8-Words test: The 8-Wordstest [20] is used to assess the retention of verbal auditory information over a period of time.
Facial recognition test
The Facial Recognition Test is a subtest of the Rivermead Behavioural Memory Test [21] and is used to assess visual long-term memory.

Digit span
This test consists of two parts: Digit span Forward and Digit Span Backward. The test is used to assess attention and executive function [22].

Rule shift cards
The rule shift cards test is a subtest of the Behavioural Assessment of the Dysexecutive Syndrome (BADS). This test measures mental flexibility and possible perseverative tendencies.

Key search test
The key search test is used to assess the ability to plan a strategy in order to solve a problem, which is considered part of the executive functioning [23].

Verbal fluency tests
The verbal fluency test is used to investigate a variety of cognitive processes, e.g. long-term verbal memory, inhibition and executive functioning [24,25]. A domain ‘Cognition’ was composed of the z-scores belonging to the above mentioned tests (Cronbach’s alpha: 0.88).

Mood
Symptom Checklist-90 (SCL-90): The SCL-90 [26] is a self-report measure and consists of nine scales, from which only two subscales (Anxiety and Depression scale) are administered in this study.

Pain
The Coloured Analogue Scale (CAS): The CAS [27], is a non-verbal scale, meant to assess the intensity of pain. The participant is asked to place a plastic slide on a scale ranging from 0 to 100, where a score of 0 indicates ‘no pain at all’ and a score of 100 indicates ‘the most unbearable pain’.

Medication
The following medication usage was listed: Analgesics, antibiotics, vitamins, antidepressants, cardiovascular-medications, diabetes-medications, gastrointestinal-medication and Hormones.

Procedure
Participants received an intravenous injection weekly, for lab control e.g. thrombosis or diabetes. Each of these residents was approached and asked whether they were willing to participate in this study. They were also tested whether they understood the meaning of the Coloured Analogue Scale. If a resident was willing to participate he or she (or their legal representative) was asked to sign an informed consent. Immediately after a qualified employee of ATAL-Medical Diagnostic Centre administered the injection, the participant was asked to indicate the intensity of the experienced pain on the Coloured Analogue Scale. The different cognitive tests were administered within two weeks after the pain score was obtained.

Data analysis
In order to analyze the relationship between acute pain perception and cognition, a linear regression was performed. Stepwise regressions were performed to analyze whether comorbidities, medication-usage and depression-scores also contributed to the explained variance of the acute pain perception. All analyses were executed by the SPSS-PC program, version 23.0, with a significance level of < 0.05.

Results

Cognition and pain
A significant negative relationship was found between acute pain perception and cognition, r = -0.34, p = 0.01.

Depression, anxiety and pain
In order to analyze whether the scores of the depression and anxiety scale, SCL-90, influenced the perception of acute pain, a standard hierarchical stepwise regression has been executed. The SCL-90 scores did not seem to contribute in explaining variance of the acute pain perception scores. Results are summarized in Table 2.

Medication usage and pain
A standard hierarchical stepwise regression was also used to analyze whether medication usage influenced the perception of acute pain. Adding the total score of the medication usage as predictor did not increase the explained variance of the model. Results are summarized in Table 2.

Comorbidities and pain
The variables hypertension, diabetes type 2, cardiac problems and peripheral white matter problems are predictors of (cardio) vascular problems. In order to analyze whether those variables influenced the perception of acute pain, a total score of those comorbidities was computed and a standard hierarchical stepwise regression has been executed. However, this did not improve the proportion of explained variance of the model. Results are summarized in Table 2.

Discussion
This study examined the relationship between acute pain perception and cognition in cognitively impaired older persons. In order to examine this relationship, 59 nursing home residents underwent a neuropsychological assessment and an assessment of their pain perception directly after a venipuncture.

Acute pain perception showed a negative relationship with cognition, implying that higher acute pain perception was associated with more cognitive impairment. In other words, the lower the cognition score, the higher the pain experience. The question arises how this finding can be explained. Our findings are in line with studies on pain in patients with vascular dementia [19]. Patients with vascular dementia show a combination of decreased cognitive functions, in particular executive functions, and an increase in the motivational-affective aspects of pain [28,29]. One explanation why a decrease in cognition is associated with an increase in pain perception might be that executive functions largely depend on the functioning of the prefrontal cortex [30]. The prefrontal cortex is also involved in pain suppression [31]. In other words, a decline in the functioning of the prefrontal cortex might cause both a decline in cognition, as an increase in pain experience.

Considering that cognitive decline leads to an inability to communicate about pain, these findings suggest a risk for undertreatment of pain in cognitively impaired older people. It is known that normal aging may coincide with white matter neuropathology [32], particular in those with a cognitive impairment [33]. White matter neuropathology in aging can only be detected by neuroimaging, which was not feasible in this study. Therefore we controlled

<table>
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<th>max</th>
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</table>
for comorbidities such as cardiac problems, peripheral vascular problems, hypertension [34] and diabetes type 2 [34,35] which we considered markers for (cardio)vascular problems. Remarkably, however, hypertension, the main cause for white matter lesions [36] and other comorbidities did not significantly contribute to the explained variance of the acute pain-scores in our study. Medication usage also didn't significantly contribute to explaining the acute pain perception scores. A possible explanation why comorbidities did not contribute in explaining the model could be that the chosen markers were not accurate enough as a predictor for white matter lesions in the brain. We controlled for diabetes for example, but because of the lack of proper diagnosis in nursing homes it was not possible to control for the duration of the disease and stability of the patient, which might also be important predictors for neuropathology [37,38]. Although we controlled for mood using the depression and anxiety scales of the SCL-90, the usage of a specific depression questionnaire, such as the Beck Depression Inventory, to control specifically for depression might be of added value in further studies. The use of observational geriatric and depression scales might be of added value because participants who are in an advanced stage of dementia are not always able to communicate their pain symptoms accurately [39]. Also, next to memory, depressive symptoms could have influenced pain perception scores as well [40].

Conclusion and Limitations

Obviously, the sample we studied consisted of nursing home residents which were not always properly diagnosed and might even have (a combination of different types of) dementia considering their high age. In this study we couldn't control for these variables due to the lack of MRI scans.

Although our present study showed some interesting results, these should be considered with caution. Future studies could replicate the findings in this study with larger groups of participants with different diseases where white matter lesions can occur. This might clarify above mentioned relationships between acute pain perception and patients with different kinds of white matter problems.

Acknowledgments

The authors are grateful to the staff members of the St. Jacob and Groenhof nursing home for their hospitality and help in conducting the study. The authors declare no conflict of interest.

Table 2. Stepwise regression of several predictors on acute pain perception.

<table>
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</table>

Funding

The authors declare they have not received any funding (form any organization).

References

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