Pain experience relates to blood pressure in nursing home residents with chronic pain

This chapter is based on:

Oosterman, J.M., de Vries, K., & Scherder, E.J.A.
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Abstract

Pain assessment and effective pain treatment pose major problems in the elderly population, specifically in nursing home residents. Previous research indicates that pain experience may correlate with blood pressure (BP). A negative relationship between BP and pain report in patients without chronic pain has been observed, whereas a reversed association has been reported in chronic pain patients. This relationship may be crucial with regard to effective pain treatment in the aged population. Therefore, the present study examined the relationship between pain and BP in nondemented nursing home residents, distinguishing between patients with and without chronic pain. The results showed that in chronic pain patients, a positive association between diastolic BP and pain affect was present. No association between BP and pain was observed in the group without chronic pain.
Introduction

With the population increasing in age, an increase in the prevalence of age-related diseases can be anticipated. For example, it is known that aging coincides with an increase in painful conditions (Horgas & Elliott, 2004). The experience of pain might be related to several conditions, including blood pressure (BP) (Bruehl, Chung, Ward, Johnson, & McCubbin, 2002). An interaction between cardiovascular and pain regulatory systems is supported by the phenomenon of hypertension-related hypoalgesia. Several studies reveal a decrease in pain sensitivity following acute pain in hypertensive but also in normotensive subjects with elevated BP (Bruehl et al., 2002; Campbell, Hughes, Girdler, Maixner, & Sherwood, 2004; Guasti et al., 1996). However, the interaction between cardiovascular and pain regulatory systems and, hence, the relationship between BP and pain sensitivity, appears to be altered in chronic pain patients. These patients may present with increased, instead of decreased, sensitivity to acute pain in the context of high BP (Bragdon et al., 2002; Bruehl et al., 2002). Even in the absence of an acute pain stimulus, chronic pain patients reveal an increase in pain sensitivity in relation to elevated BP (Bruehl et al., 2002). These studies however are limited in that they included middle-aged adults, and not a very old population who for example live in nursing homes. This population is especially interesting considering the high prevalence of painful conditions in the oldest old (Jakobsson, Hallberg, & Westergren, 2004) together with possible alterations in pain experience (Gibson & Farrell, 2004).

The goal of the present study is to establish whether BP predicts pain experience, distinguishing between subjects with and without chronic pain, in nursing home residents. In the residents without chronic pain, the experience of acute pain (e.g. occasional headache) is likely to be present and, hence, pain complaints can be anticipated. As such, a negative relationship between pain and BP can be predicted in this population. The chronic pain group is expected to reveal a positive relationship between BP and pain experience.

Methods

Subjects

The recruitment of participants was accomplished in cooperation with several nursing homes in Amsterdam, the Netherlands. The selection procedure of subjects was as follows: medical records from nursing home residents were screened to select those subjects free of a history of: neurodegenerative disease (e.g. dementia, Parkinson’s disease), stroke, transient ischemic attack, schizophrenia, alcohol or other substance abuse, thyroid disease, and severe depression. The Mini Mental State Examination (MMSE) (Folstein, Folstein, & McHugh, 1975) was used as a screening instrument to exclude possible dementia: a score of ≥ 24 was required for participation which provides a fairly accurate indication of the absence of dementia (Grut, Fratiglioni, Viitanen, & Winblad,
Depressive symptoms, rated with the Symptom Checklist-90 (SCL-90) (Arrindell & Ettema, 1986), and use of antihypertensive agents (e.g. thiazide diuretics, ACE inhibitors), and non-steroidal anti-inflammatory drugs (NSAID’s) and/or other analgesic medication, based on medical records, were noted. Eighty subjects participated. All subjects gave an informed consent. The study was approved by the local ethics committee.

Pain Assessment

In the present study, both pain intensity and pain unpleasantness (i.e. pain affect) were measured. Pain intensity was assessed using two visual analogue scales, namely the Coloured Analogue Scale (CAS) (McGrath et al., 1996) and the Faces Pain Scale (FPS) (Bieri, Reeve, Champion, Addicoat, & Ziegler, 1990). For the CAS, scores can vary from 0 (no pain) to 100 (most pain). Scores for the FPS can vary between 0 (neutral face) and 6 (most pain).

The CAS and the Number of Words Chosen –Affective (NWC-A) from the McGill Pain Questionnaire (Melzack, 1987) were employed to measure pain affect. The CAS is a visual scale and comparable to the pain intensity scale, with scores ranging between 0 (no suffering) and 100 (most suffering). The NWC-A is a verbal rating scale. Scores range between 0-15. Scales that use descriptive words have been shown to obtain high levels of both sensitivity and reliability (Herr, Spratt, Mobily, & Richardson, 2004). Full comprehension of the visual pain scales, as is inexplicable for valid pain measurements, was assessed as described previously (Scherder & Bouma, 2000).

Pain was measured twice, with approximately a 4-week interval between both measurements. Using standardized scores, a composite score for both pain intensity and pain affect was calculated.

Chronic Pain

Chronic painful conditions were scored in 5 categories: (1) arthrosis/arthritis, (2) osteoporosis, (3) miscellaneous, such as neuropathy, (4) recent fractures (within the last year), and (5) recent surgery (within the last year).

Blood Pressure

BP was measured in upright sitting position using an aneroid Sphygmomanometer. Subjects were visited on two different occasions to perform BP readings, with (on average) a 4-week interval (concurrent with both pain measurements). On each occasion, BP was measured twice, resulting in 4 BP readings. Average systolic and diastolic BP (SBP and DBP, respectively) was calculated from these readings.
Statistical Analysis

Mann-Whitney U tests and Chi-square tests were applied to test for possible differences between subjects with and without chronic pain in age, sex, SBP, DBP, use of antihypertensive medication, use of NSAID’s and/or other analgesic medication, and history of hypertension. Hierarchical regression analyses were performed, separately for the group with and without chronic condition, in order to examine how BP relates to pain experience. The pain intensity and pain affect domains were entered as dependent variables. In the first step, possible contributions of age, sex, antihypertensive medication, NSAID’s and/or other analgesic medication, and depressive symptoms were considered. After this, SBP and DBP were examined. Both the confounders and BP variables were subjected to stepwise selection procedure. Significance for entry was set at $p < .05$.

Results

Ten subjects showed either miscomprehension of the FPS or the CAS pain scales (7 and 3 subjects respectively) and were therefore excluded from further analyses. Patient characteristics of the remaining 70 patients are described in Table 1. Out of a total of 70 participants, 52 (74.3%) suffered from a chronic painful condition. No differences between subjects with and without chronic pain were noted for age, sex, SBP, DBP, use of antihypertensive medication, and history of hypertension. As expected, patients with chronic pain more frequently used analgesic medication ($\chi^2 = 9.87, p < .01$).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean ± SD)</td>
<td>84.9 (5.1)</td>
</tr>
<tr>
<td>Sex (% male)</td>
<td>31.4</td>
</tr>
<tr>
<td>MMSE (mean ± SD)</td>
<td>27.2 (1.7)</td>
</tr>
<tr>
<td>SBP (mean mmHg ± SD)</td>
<td>138.4 (20.4)</td>
</tr>
<tr>
<td>DBP (mean mmHg ± SD)</td>
<td>70.7 (10.5)</td>
</tr>
<tr>
<td>Chronic pain (%)</td>
<td>74.3</td>
</tr>
<tr>
<td>Analgesic medication (%)</td>
<td>48.6</td>
</tr>
<tr>
<td>Antihypertensive medication (%)</td>
<td>70.0</td>
</tr>
</tbody>
</table>

*DBP: Diastolic Blood Pressure; SBP: Systolic Blood Pressure; MMSE: Mini Mental State Examination*

Blood Pressure and Pain Perception

In patients with chronic pain, DBP positively predicted pain affect ($\beta = 0.297, p < .05$), together with depressive symptoms ($\beta = 0.381, p < .01$) and use of NSAID’s
and/or other analgesic medication ($\beta = 0.422, p < .01$). No significant effect of SBP or DBP emerged with regard to pain intensity, which was predicted by use of NSAID’s and/or other analgesic medication ($\beta = 0.542, p < .01$).

For the non-chronic pain group, no effects of SBP or DBP were noted with regard to pain intensity and affect. Antihypertensive medication ($\beta = 0.491, p < .05$) and depressive symptoms ($\beta = 0.677, p < .01$) predicted pain intensity. Depressive symptoms ($\beta = 0.677, p < .01$) and use of NSAID’s and/or other analgesic medication ($\beta = 0.394, p < .05$) furthermore predicted pain affect in this population.

Discussion

The present results show that, in this nursing home population suffering from chronic pain, a positive relationship between pain affect and DBP exists. This study supports previous findings of a distorted interaction between cardiovascular and pain regulatory systems in chronic pain patients (Bragdon et al., 2002; Bruehl et al., 2002). The clinical relevance of this observation is furthermore emphasized considering the high prevalence of chronic pain conditions in this sample of nursing home residents. Taken together, these findings provide important implications for effective pain treatment in this population, specifically in case of high DBP.

The expected negative association between pain and BP in participants without a chronic pain condition was not observed. In this population, acute pain complaints such as occasional headache or back pain may be present. In contrast to earlier studies concerning the pain-BP relationship in pain-free participants (Guasti et al., 1996; Bruehl et al., 2002), no pain stimulus was applied in the present study. A current pain sensation (as induced by a pain stimulus) might be necessary for the BP-pain association to be detected.

In the general population, several underlying mechanisms have been proposed that can mediate the interaction between the cardiovascular and pain regulatory systems (Bruehl & Chung, 2004). An important role has been ascribed to baroreceptors, which are related to both BP and pain inhibitory pathways. In short, an increase in BP (which might result from pain) activates these baroreceptors, which, in turn, activates pain inhibitory pathways. In chronic pain patients, several factors may contribute to an alteration in the BP-pain relationship (Bruehl & Chung, 2004). First of all, continuous stimulation as a result of chronic pain might desensitize the baroreceptors resulting in decreased activation of pain inhibitory pathways. Alternatively, impaired functioning of inhibitory pain pathways as a result of continuous activation or increased activation of pain facilitatory pathways might contribute to the altered BP-pain relationship.

The reliability of the present results concerning BP in relation to pain experience in nursing home residents is stressed by several observations. First of all,
depressive symptoms significantly predicted pain affect in subjects both with and without chronic pain, as well as pain intensity in subjects without chronic pain. A strong relationship between depressive symptoms and pain experience has been reported previously (Kuch, 2001; Lépine & Briley, 2004), which stresses an important association of these symptoms with pain experience. The reliability is furthermore increased in that full comprehension of the pain scales was established. The reliability of pain assessments is specifically important when applying pain scales in cognitively impaired groups, such as demented subjects. As such, the present study indicates a positive association exists between DBP and pain affect in nondemented chronic pain patients.