Observational study

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Posttraumatic stress and autobiographical memory in chronic pain patients

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Abstract

Background and aims: Posttraumatic stress disorder (PTSD) is related to more severe pain among chronic pain patients. PTSD is also related to dysfunctions or biases in several cognitive processes, including autobiographical memory. The autobiographical memories are our memories of specific personal events taking place over a limited amount of time on a specific occasion. We investigated how two biases in autobiographical memory, overgeneral memory style and negative emotional bias were related to pain, PTSD and trauma exposure in chronic pain patients.
Methods: Forty-three patients with diverse chronic pain conditions were recruited from a specialist pain clinic. The patients were evaluated for psychiatric diagnosis, with a diagnostic interview Mini-International Neuropsychiatric Interview (M.I.N.I) and for exposure to the most common types of traumatic events with the Life Event Checklist (LEC). The patients were tested with the 15-cue-words version of the Autobiographical Memory Test (AMT). In this test the participants are presented verbally to five positive, five neutral and five negative cue words and asked to respond with a personal, episodic memory associated with the cue word. The participant's responses were coded according to level of specificity and emotional valence. Pain intensity was assessed on a Visual Analogy Scale (VAS) and extent of pain by marking affected body parts on a pre-drawn body figure. Comparisons on autobiographical memory were made between PTSD and non-PTSD groups, and correlations were computed between pain intensity and extent of pain, trauma exposure and autobiographical memory.
Results: PTSD and extent of pain were significantly related to more negatively emotionally valenced memory responses to positive and negative cue words. There were no significant difference in response to neutral cue words. PTSD status and pain intensity were unrelated to overgeneral autobiographical memory style.
Conclusions: A memory bias towards negatively emotionally valenced memories is associated with PTSD and extent of pain. This bias may sustain negative mood and thereby intensify pain perception, or pain may also cause this memory bias. Contrary to our expectations, pain, trauma exposure and PTSD were not significantly related to an overgeneral memory style.
Implications: Cognitive therapies that have an ingredient focusing on amending memory biases in persons with comorbid pain and PTSD might be helpful for this patient population. Further investigations of negative personal memories and techniques to improve the control over these memories could potentially be useful for chronic pain treatment.

Keywords: traumatic stress; PTSD; autobiographical memory; chronic pain.

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1 Introduction

Chronic pain is among the most common and costly health problems in Europe [1] and is associated with a two- to threefold increased risk of mental disorders [2]. Posttraumatic stress disorder (PTSD) is a mental disorder being caused by the person being exposed to death, threatened death, actual or threatened serious injury, or actual or threatened sexual violence. These events, called potentially traumatizing events, can further be divided into intentional and non-intentional. Intentional

events are deliberate harm infliction, such as interpersonal violence, torture, and war-related trauma. In non-intentional events, the harm is not caused deliberately, as with natural disasters and serious illness in someone close. Non-intentional events are related to more transitory PTSD symptoms, while intentional events are related to more enduring symptoms and negative treatment outcomes [3, 4].

PTSD is associated with a doubled risk of chronic pain [5, 6] and may be even more strongly associated with widespread chronic pain [7]. Why PTSD and chronic pain are associated is largely unknown, but both biological and cognitive factors may be important. Memory is a cognitive domain central to PTSD symptomatology, and PTSD may be seen as a memory disorder [8], where PTSD symptomatology is caused and/or sustained by memory dysfunctions or biases, including lessened control of memory retrieval processes [9]. According to the memory based models of PTSD, fragmented, and highly emotional cognitive material may enter consciousness uncontrolled. These intrusive memories may, act as drivers for PTSD symptoms such as avoidance and hyperarousal. Therefore, understanding memory dysfunctions might improve our understanding of how PTSD is related to chronic pain.

One memory function of particular interest in traumatic stress research is autobiographical memory. Autobiographical memories are memories of specific personal events taking place over a limited amount of time on a specific occasion (e.g. "Last Friday afternoon, I saw a dead cat in the park"). The autobiographical memory system is strongly related to our identity and serves crucial functions such as using previous experiences to solve problems, navigate daily life and plan future action [10–12]. The most-investigated autobiographical memory bias related to traumatic stress is overgeneral memory style [13]. A person with an overgeneral autobiographical memory style tends to be unable to report specific personal episodic memories when prompted. Rather, the person tends to retrieve general memories of repeated events, such as "On Fridays I go for a walk in the park", or memories that refer to extended periods of time ("I used to own a blue bike") [14, 15].

Compared to the amount of literature on traumatic stress and depression, there is limited research on autobiographical memory in people with chronic pain. A majority of the early autobiographical memory studies investigated pain-relevant memories [16–18]. More recent studies have investigated autobiographical memory functioning in chronic pain patients more broadly and with similar procedures as in posttraumatic stress research. Compared to healthy controls, people with chronic pain show an overgeneral memory bias, which is related to depression and feelings of being unable to cope with pain [19], and report more negative emotional memories when in pain [20].

The current study elaborates on previous research by investigating autobiographical memory biases in chronic pain patients in light of their previous trauma exposure (divided into intentional and non-intentional) and PTSD status. If memory dysfunctions are important drivers for PTSD symptoms, these memory dysfunctions might also increase or sustain pain and functional disability in patients exposed to trauma. Trauma-exposed patients with an overgeneral memory style may more easily succumb to feelings of hopelessness and despair in ways similar to those reported from research on autobiographical memory in depression [21].

We sought to investigate whether an overgeneral memory style and a bias towards reporting memories with negative emotional valence are related to current pain and extent of pain in chronic pain patients. We hypothesized that an overgeneral memory style and a tendency towards retrieving memories with negative emotional memory valence would be related to trauma exposure, PTSD, and pain.

2 Methods

2.1 Participants

Patients at their first appointment at a large university hospital specialized pain clinic were invited to participate in an interview study on traumatic stress, memory, and pain. The patients were referred by their general practitioner or other departments at the hospital for assessment and treatment of chronic pain. This clinic offers multidisciplinary pain treatment by a specialist team with anesthesiologist, physiotherapist, nurse, and psychologist. All patients with an adequate understanding of Norwegian were eligible for inclusion. The patients were interviewed by the first author, a specialist in clinical psychology. All new patients at the clinic on days of data collection were approached for participation, and approximately half chose to participate. The most common reason given for not participating was lack of time. Written informed consent was collected from all participants prior to the interview, and all participants received 200 NOK (25 €) in compensation. The study was approved by the Regional Committee for Medical and Health Research Ethics, Health Region South-East (ID: 2010/1646a).

2.2 Measurement

Background demographic information was collected from electronic patient records.

2.2.1 Trauma exposure

The participant's trauma exposure was assessed with the Life Events Checklist (LEC). The LEC has 17 items with four response categories (0 = *not relevant*, 1 = *confronted with*, 2 = *witnessed*, and 3 = *it happened to me*). Other studies have reported that the LEC has adequate reliability and validity [22]. For further analysis, the LEC items were divided into items assessing exposure to intentional traumatic events such as interpersonal violence, sexual abuse, and war, and items assessing non-intentional exposure such as accidents, natural disaster, and illness.

2.2.2 Psychiatric diagnosis

The M.I.N.I International Neuropsychiatric Interview PLUS (MINI 5.0.0, Norwegian adaptation, hereafter MINI) is a structured diagnostic interview assessing Axis I DSM IV psychiatric disorders [23]. The Norwegian version of the MINI has been validated previously and found to have adequate reliability [24].

2.2.3 Pain

Current pain intensity was assessed by self-report, where the participants rated their pain on a 10 cm visual analog scales (VAS) with the ends of the scale were marked as "No pain" and "Worst possible pain". Extent of pain was assessed on a pre-drawn body picture where the participants marked their pain-afflicted body parts.

2.2.4 Autobiographical memory test

Participants were presented with the Norwegian version of the autobiographical memory test with 15 cue words: five positive, five neutral and five negative. The AMT has demonstrated adequate psychometric properties in previous research [25] and has previously been used in research in Norwegian speaking populations [26]. The specificity and emotional valence of the recorded memories were coded by two independent expert coders blind to the participant's diagnostic status. All data analyses were performed with SPSS version 22.

3 Results

Demographic information, trauma exposure and self-reported pain are presented according to PTSD status in Table 1. The participants were between 24 and 66 years old (M = 43.3, SD = 10.2), and 27 (63%) were women. All participants reported experiencing pain for at least 6 months. The most common types of pain were muscular skeletal pain and neuropathic pain. The participants scored between 0 and 44 on the LEC (M = 13.3, SD = 9.2). Twelve participants met the diagnostic criteria for PTSD. Women were overrepresented in the PTSD group, where 11 of the 12 participants were women. The number of cue words that elicited specific memories on the autobiographical memory test ranged from 2 to 14 (M = 9.2, SD = 3.2).

Our first analysis investigated whether trauma exposure was related to autobiographical memory specificity (see Table 2). The bivariate correlation between trauma exposure and autobiographical memory specificity ($r = 0.09$, ns) was not significant. When trauma exposure was spilt into non-intentional and intentional events, intentional events and autobiographical memory specificity were borderline significantly correlated ($r = 0.31$, $p < 0.06$), while non-intentional event and autobiographical memory specificity was not significantly correlated ($r = 0.15$, ns).

Our second analysis investigated the relationship between PTSD, autobiographical memory specificity, and pain. While there was a tendency towards participants in the non-PTSD group reporting more specific memories, there was no significant difference in specificity between

Table 1: Participants demographics, trauma exposure, and pain by PTSD status.

	All participants	PTSD ($n = 13$)	Non-PTSD ($n = 30$)
Demographics			
Age (M)	42.3	43.7	41.5
Gender (% female)[a]	63	92.3	50
Trauma exposure[a]	13.33	18.2	11.2
Intentional events[a]	5.7	7.3	3.8
Non-intentional events	7.6	8.2	7.3
Pain			
VAS	5.7	6.1	5.3
Extent[a]	3.1	4.1	2.8

[a]Sign at $p < 0.05$.

Table 2: Autobiographical memory, trauma exposure, PTSD and pain: correlations.

	1	2	3	4	5	6
1. ABM specificity						
2. Trauma exposure	−0.09					
3. Intentional traumatic events	−0.29	0.81[b]				
4. Non-intentional traumatic events	0.15	0.81[b]	0.31[a]			
5. PTSD	0.16	0.36[a]	0.50[b]	0.36[a]		
6. VAS pain	−0.01	0.04	0.01	0.04	0.19	
7. Extent of pain	0.06	0.24	0.33[a]	0.24	0.46[b]	0.26

ABM = autobiographical memory; VAS pain = current pain report on a 10 point Visual Analogue Scale.
[a]Correlation is significant at the 0.05 level (two-tailed).
[b]Correlation is significant at the 0.01 level (two-tailed).

participants with PTSD (M = 9.51, SD = 3.05) and other participants [M = 10.42, SD = 3.23, F (1.36) = 0.56, ns]. Further, there was no significant relationship between autobiographical memory specificity and VAS score (r = 0.01, ns) or extent of pain (r = 0.07, ns). Because the PTSD patients were almost exclusively women, these analyses were repeated controlling for gender, with similar findings.

Third, we analyzed the emotional valence of the reported memories (see Fig. 1). This analysis was performed in two ways; the first included all memory responses, while the second included only specific memory responses. As these two analyses led to similar results, they are jointly reported. Participants with PTSD reported memories with more negative emotional valence when presented with cue words that were negatively (t (39) = –3.1, p < 0.05) and positively (t (39) = –2.4, p < 0.05) valenced. We found the same effect for extent of pain; participants with more pain-affected body parts reported significantly more negative emotionally valenced memories to positive cue words (r = 0.44, p < 0.05). VAS pain score and trauma exposure were unrelated to memory valence. There was no effect of neutral valenced cue words on memory retrieval, nor any effect for any of the included variables on the positive emotional valence of reported memories.

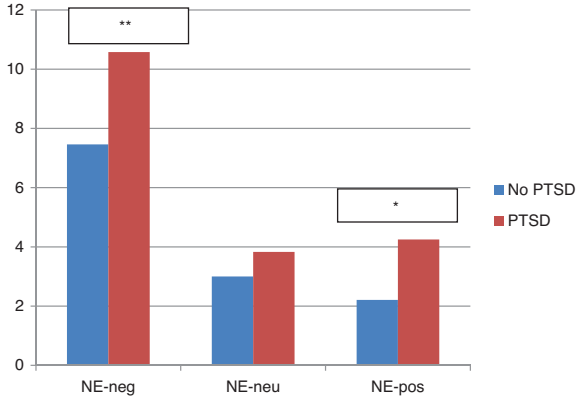

Fig. 1: Negative emotional valence by negative, neutral, and positive cue words and PTSD. NE-neg = negative emotional valenced memory response to negative cue words; NE-neu = negative emotional valenced memory response to neutral cue words; NE-pos = negative emotional valenced memory response to positive cue words. *F (1.36) = 9.73, p = 0.004. **F (1.36) = 5.57, p = 0.024.

4 Discussion

We investigated the relationship between autobiographical memory biases, trauma exposure, PTSD, and pain in chronic pain patients. We hypothesized that overgeneral and more negative emotionally valenced autobiographical memories would be related to trauma exposure, PTSD, and pain. Our hypotheses were partially supported. Participants exposed to intentional trauma, participants with PTSD, and participants with more pain-affected body parts retrieved more negative emotional memories in response to positive and negative cue words. The hypothesis about overgeneral autobiographical memory being related to PTSD and pain was not supported.

When we analyzed the relationship between overgeneral memory and trauma exposure, interesting differences emerged when dividing trauma exposure into intentional and non-intentional events. Non-intentional events were not statistically related to overgeneralized memory, but there was a tendency towards this exposure being related to more specific memory. Exposure to intentional events was related to more overgeneral memories, as hypothesized. There is, to our knowledge, little research comparing intentional and non-intentional events in relation to overgeneral memory. However, other studies have reported exposure to intentional events to be related to more psychological damage and higher conditional risk for PTSD [4, 27, 28]. Our finding is therefore consistent

with general findings within the PTSD literature. This difference in trauma exposure may also be relevant for the risk of chronic pain, and should be replicated in studies with bigger sample.

Participants with PTSD and those with more pain-affected body parts reported more negative emotional memories in response to positive and negative valenced cue words. People with PTSD may have less emotional control [9], and therefore experience more negative emotional memories popping up uncontrollably. These negative memories could lead to more negative current emotions and thereby maintain chronic pain as described in the mutual maintenance model of chronic pain [29]. The positive relationship between PTSD and the extent of pain could also be due to common underlying psychophysiology causes, such as chronic hyperarousal. Chronic hyperarousal is a central PTSD symptom [30] and might explain how PTSD is related to autoimmune illnesses. Boscarino suggested a model where higher level of T-cells and lower cortisol levels are results of trauma exposure and a risk factor for both PTSD and autoimmune diseases such as rheumatoid arthritis [31]. Since rheumatoid arthritis and fibromyalgia are defined by more generalized pain, this model might explain the why persons with PTSD in particular have more generalized rather than more localized pain [31, 32].

Generalized pain, as opposed to localized chronic pain, may represent another type of chronic pain where central cognitive and affective processes are more important for the pain experience, possibly through mechanisms such as central sensitization [33, 34]. People with more generalized chronic pain have higher levels of psychosocial disability [35, 36] than people with localized pain. Thus, the negative bias in the retrieved memories in people with more generalized pain might be related to low levels of coping and high levels of hopelessness.

We found no overgenerality effect related to PTSD in this study. There might be several reasons for this somewhat unexpected finding. One is related to all participants in the study had chronic pain, with average medium to high levels of pain at time of testing. As current pain affect memory functioning, the failure to find the expected overgenerality effect may be due to all participants in this study reporting significant levels of pain and, therefore, more overgeneral memories. Chronic pain is related to reduced working memory [37], which is one of the cognitive processes involved in autobiographical retrieval [21], and consequently all participants may have had reduced specificity independent of PTSD status. This hypothesis is consistent with [19] who found that people with chronic pain report more overgeneral memories compared to healthy controls. The high level of pain in all participants might therefore have washed out an effect of trauma exposure or PTSD on memory specificity. Additional controls such as a group of PTSD patients without pain and healthy controls would have been useful for interpreting this finding.

Further, we dichotomized the PTSD symptoms into two groups according to diagnosis, rather than using the PTSD symptoms to form a continuous symptoms scale. A continuous PTSD measure would have offered more statistical power and a better chance to detect small effect sizes. It is worth noting, however, that there was only a small difference between the PTSD and the non-PTSD group, and there was a tendency towards those in the PTSD group reporting more specific memories (about 1/3 of a SD). Therefore, our finding of no overgenerality effect related to PTSD is less likely to have been caused by low statistical power alone.

However, the rather small sample size in this study limited the chance of finding a small to medium-sized real effect and the possibilities of building more complex models investigating interactions and including control variables. A larger sample size would have allowed more accurate effect estimates.

In sum, this study reported several potentially important associations between autobiographical memory biases, that are non-specific i.e. overgeneral or have a negative emotional valence, PTSD, and chronic pain. Our findings were mainly in line with previous research, except that we did not find any overgenerality effect. Our findings have relevance for development of models for chronic pain and PTSD. While cognitive-based therapies for pain have some documented effect [38], the effect sizes are rather small and further developments are needed. The clinical implications of these findings is that cognitive therapies that have an ingredient focusing on amending memory biases in persons with comorbid pain and PTSD, might be helpful for this patient population. Further investigations of negative personal memories and techniques to improve the control over these memories could potentially be useful for chronic pain treatment.

Authors' statements

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Informed consent: Written informed consent was collected from all participants prior to the study interview.

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