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Alexithymia is associated with low tolerance to experimental painful stimulation

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Abstract

Alexithymics are known to report more somatic complaints than individuals scoring low on alexithymia. It was examined whether alexithymia would also be associated with enhanced sensitivity to an externally administered unpleasant physical stimulus. Forty-one healthy male and female subjects with a mean age of 33.9 years completed the 20-item version of the Toronto Alexithymia Scale and participated in a laboratory protocol consisting of exposure to painful electric stimulation. Multiple stepwise regression analyses revealed that after controlling for sensory threshold, duration of stimulation, and self-reported caffeine consumption, alexithymia predicted significantly pain tolerance level ($\beta = -0.33$, $P = 0.01$). Externally oriented thinking and difficulty identifying feelings, but not difficulty communicating feelings, were responsible for this association. Previous findings and the present results together indicate that alexithymia may be associated with an enhanced sensitivity to both internal (somatic) unpleasant sensations and externally induced pain, suggesting a potential general hypersensitivity to unpleasant stimuli in individuals scoring high on this trait.

Keywords: Alexithymia; Electric current; Experimental pain; Hypersensitivity

1. Introduction

Alexithymia is a personality dimension, defined by a difficulty in verbal expression and even experience of emotions (Sifneos, 1973; Taylor et al., 1991). Approximately 14–19% of the normal adult population and 30–40% of general psychiatric out-patients have been estimated to be alexithymic (Taylor et al., 1991, 1992; Todarello et al., 1995). Although to date empirical evidence for causal directions has not been provided, alexithymia has been shown to be associated with a variety of somatic complaints, which may put a heavy burden on the society in terms of medical costs (Taylor et al., 1992). Alexithymics are known to report more somatic complaints than individuals scoring low on alexithymia (Taylor et al., 1992; Cohen et al., 1994; Lumley et al., 1997). Chronic or somatoform pain patients have been shown to score relatively high on alexithymia (Acklin and Alexander, 1988; Cox et al., 1994; Lumley et al., 1996b), although *within* groups of chronic pain patients the relationship between alexithymia and more specific pain parameters has been less clear. For instance, within samples of chronic pain patients, alexithymia was not related to reported pain intensity and disability (Millard and Kinsler, 1992; Cox et al., 1994), whereas within a specific sample of patients with chronic cancer pain, alexithymia was associated with longer duration of pain (Dalton and Feuerstein, 1989).

It may be hypothesized that the association between alexithymia and increased risk for having medically unexplained somatic complaints is mediated by a general hypersensitivity to unpleasant physical stimulation (Lumley et al., 1996b), either proprioceptive or external. Several examples of indirect evidence for this notion may be provided. For example, Wise and Mann (1994) showed that somatosensory amplification, as measured by a self-report questionnaire correlated with alexithymia. In addition, it has been found that coronary patients with exercise-provoked chest pain, but without objective evidence of ischemia, were more often those who scored higher on some facets of the alexithymia construct (Lumley et al., 1997).

However, studies assessing directly sensitivity to exposure to externally administered pain stimuli have been extremely scarce. To our knowledge, only two have been conducted. Sivik (1993) found a positive correlation

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between alexithymia and sensitivity to palpational stimulation. Unfortunately, methodological shortcomings (unknown method of palpational stimulation and unknown validity of her assessment of alexithymia by means of a Thematic Apperception Test-like procedure; Lumley et al. (1996b) makes the results difficult to interpret. In contrast, De Zwaan et al. (1996) failed to find any association between alexithymia and pain threshold to thermal and pressure stimuli. However, their study was conducted primarily among a selected group of patients with an eating disorder.

Therefore, in the present study, the primary aim was to examine the relationship between alexithymia and experimentally-induced pain more systematically, using reliable and validated instruments, in a sample of healthy adult volunteers. In addition, we have differentiated between the various facets of alexithymia, since they have been found to have divergent relationships with symptom reporting and other health-related variables (Lumley et al., 1996a, 1997). Finally, besides pain threshold, which was the only pain sensitivity variable used previously (De Zwaan et al., 1996), also pain tolerance and sensory threshold were assessed (the latter variable in order to control for general sensory sensitivity, as opposed to the more specific pain sensitivity).

2. Subjects and method

2.1. Study participants

Among healthy part-time undergraduate psychology students, participants were recruited by the experimenter in a face-to-face contact on the Tilburg University campus. Exclusion criteria were psychiatric history and currently taking any medication. Sixty percent of the approached population agreed to participate in the study: 18 men and 21 women, with a mean age of 33.9 years (SD 7.0). These gender and age characteristics are typical for the specific group of part-time psychology students in Tilburg.

2.2. Measurements and procedure

After informed consent was obtained (there was no drop-out after reading it), the participants received a questionnaire to complete within 1 week. In addition, an appointment was made for the laboratory session. The questionnaire included items on demographic and life-style variables and the Dutch translation of the 20-item version of the Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994a). Besides the total alexithymia score (TAS-TOT), the TAS-20 contains three subscales: (i) difficulty identifying feelings (DIF); (ii) difficulty communicating feelings (DCF); and (iii) externally-oriented thinking (EOT). The TAS-20 has been found to be a psychometrically sound instrument, both in the United States (Bagby et al., 1994a,b) and the Dutch version in The Netherlands (Bagby et al., 2000).

The subsequent laboratory protocol took place early in the evening. The session consisted of two identical electric stimulation trials with an inter-trial-interval of 30 s. The subjects were first seated and the electrodes were attached. A constant current was delivered on the ventral side of the forearm using two Ag/AgCl 8-mm electrodes. The skin below the electrode was lightly abraded in order to keep resistance below 5 kΩ. The 50-Hz current could reach a maximum of 5 mA. The participants were requested to raise themselves the intensity of the electric current from 0 mA up to their pain tolerance level (i.e. the level at which the subjects stopped the stimulation because it became 'too uncomfortable'). When raising the stimulus, the subjects first also had to indicate their sensory threshold (the first time they felt 'something') and pain threshold (the first time the stimulus became 'painful') by pressing a button. The self-administration of pain has two implications, the first of which may be considered an advantage over conventional (experimenter-controlled) stimulus delivery: (a) the effects are expected to be more purely sensory-perceptual, without concomitant confounding effects of anxiety as a result of lack of control over the stimulus (Miller, 1979); (b) since the duration of the stimulation is variable, it will be controlled for statistically, if the duration will show to be correlated with pain threshold or pain tolerance.

2.3. Statistical analysis

All statistical analyses were performed using the SPSS statistical software package. The association between the alexithymia scales and pain threshold and pain tolerance was tested by applying stepwise linear multiple regression analyses, entering first those potentially confounding variables that correlated (marginally) significantly with pain threshold or pain tolerance. In the analyses, the means of both trials were used.

3. Results

The alexithymia scores of the participants were similar to those reported in other studies using healthy adult samples (Todarello et al., 1995; Bagby et al., 2000): 46.9 (SD 12.9) for men and 43.3 (SD 10.5) for women. If one would apply the cutoff point of ≥61 (Todarello et al., 1995), three men (16.7%) and three women (13%) would be considered alexithymic in the present sample. Men showed to have a more externally oriented thinking style than women ($F(1, 39) = 5.35$, $P < 0.03$). Men and women did not differ on the other alexithymic subfactors (both $P > 0.10$).

Sensory threshold correlated highly with pain threshold ($r = 0.63$, $P < 0.001$) and pain tolerance ($r = 0.55$, $P < 0.002$). Therefore, in order to control for a potential bias resulting from effects due to a general sensitivity effect instead of specific pain sensitivity, sensory threshold was controlled for in the analyses on pain threshold and pain tolerance. In addition, pain tolerance correlated significantly with the duration of stimulation ($r = 0.36$, $P < 0.05$),

which consequently was controlled for in the analyses on pain tolerance. The average duration of a stimulation trial up to pain tolerance was 32.8 s (SD 13.1 s).

In Table 1, the pairwise correlation coefficients of the sensory and pain variables with the potential control variables and scores on the alexithymia (sub)scales can be viewed. The results of the multiple regression analyses are summarized in Table 2. Both pairwise correlations and the results of the multiple regression analyses are discussed below in the sections corresponding with the dependent variable used.

3.1. Sensory threshold

The potential control variables correlating (nearly) significantly with sensory threshold were BMI ($r = 0.30$, $P = 0.07$) and coffee consumption ($r = 0.29$, $P = 0.09$). The TAS-TOT scores did not correlate significantly with sensory threshold ($r = -0.15$, $P > 0.10$). Of the subscales, only EOT was associated with sensory threshold ($r = -0.38$, $P < 0.03$). In the multiple regression analysis, only BMI ($\beta = 0.32$, $P < 0.05$) and EOT($\beta = -0.40$, $t(33) = -2.62$, $P < 0.02$) entered the equation (total amount of explained variance of sensory threshold by the predictors (R^2) was 0.25).

3.2. Pain threshold

A trend emerged for coffee consumption and alcohol consumption to be positively linked with pain threshold ($r = 0.31$, $P = 0.07$ and $r = 0.29$, $P = 0.09$, respectively). Also in relation to pain threshold, the TAS-TOT showed no significant association ($r = -0.08$, $P > 0.10$) and only EOT showed a significant negative correlation ($r = -0.47$, $P < 0.01$). When controlling for gender ($\beta = 0.34$, $P < 0.05$; with being male coded 0 and being female coded 1) and coffee consumption ($\beta = 0.42$, $P < 0.01$), which entered the multiple regression analysis, EOT still predicted significantly pain threshold ($\beta = -0.39$, $t(31) = -2.78$, $P < 0.01$)(total R^2 of the equation = 0.40). However, when also sensory threshold was entered first($\beta = -0.53$, $P < 0.001$), the significant effect of EOT disappeared (β to enter $= -0.21$, $P = 0.11$).

Table 1
Pairwise correlations between the potential predictors and outcome variables

Potential predictor	Outcome variable		
	Sensory threshold	Pain threshold	Pain tolerance
Age	0.10	0.04	0.05
Gender[a]	−0.04	0.26	−0.15
Body mass index	0.30[b]	0.12	0.08
Alcohol (glasses per week)	0.15	0.29[b]	0.25
Coffee (cups per day)	0.29[b]	0.31[b]	0.35*
Smoking (cigarettes per day)	0.03	0.11	0.09
Exercise (hours per week)	−0.12	−0.15	0.06
Toronto Alexithymia Scale total score TAS-TOT	−0.15	−0.08	−0.41*
TAS-Difficulty identifying feelings	0.02	0.11	−0.30[b]
TAS-Difficulty communicating feelings	−0.01	0.12	−0.10
TAS-Externally oriented thinking	−0.38*	−0.47**	−0.45**

[a] Coding of gender: male = 0, female = 1 (applies also to Table 2).
$N \geq 33$; *$P < 0.05$; **$P < 0.001$.
[b] $0.05 > P > 0.10$.

Table 2
Summarized results (β coefficients) of the multiple regression analyses[a]

Predictor	Outcome variable		
	Sensory threshold	Pain threshold	Pain tolerance
Gender		0.34*	
Body mass index	0.32*		
Coffee (cups per day)		0.42**	0.34*
Sensory threshold		0.53***	0.49***
Duration			0.35**
Toronto Alexithymia Scale			−0.40
total score TAS-TOT			(−0.33)**
TAS-Difficulty identifying			−0.28
feelings			(−0.27)*
TAS-Difficulty communicating feelings			
TAS-Externally oriented	−0.40*	−0.39**	−0.44**
thinking		(−0.21)[b]	(−0.27)[c]

[a] The β values for the alexithymia variables are corrected for gender, BMI, and/or coffee consumption (between parentheses are the values when also corrected for sensory threshold and duration of stimulation).
*$P < 0.05$; **$P \leq 0.01$; ***$P < 0.001$.
[b] Not significant, $P > 0.10$.
[c] $0.05 > P > 0.10$.

3.3. Pain tolerance

Coffee consumption was positively associated with pain tolerance ($r = 0.35$, $P < 0.05$). TAS-TOT ($r = -0.41$, $P < 0.02$), EOT ($r = -0.45$, $P < 0.01$), and DIF ($r = -0.30$, $P = 0.07$) all showed negative correlations univariately. TAS-TOT remained a significant predictor of pain tolerance after control for coffee consumption ($\beta = 0.34$, $P < 0.03$): ($\beta = -0.40$, $t(33) = -2.70$, $P = 0.01$). This was also the case after additional correction for sensory threshold ($\beta = 0.49$, $P < 0.001$), and duration of the stimulation ($\beta = 0.35$, $P < 0.01$): ($\beta = -0.33$, $t(32) = -2.67$, $P = 0.01$; Fig. 1) (total R^2 of the equation = 0.53). Also, EOT predicted significantly pain tolerance after control for coffee consumption ($\beta = -0.44$, $t(33) = -3.05$, $P < 0.01$), but became marginally significant when also sensory threshold and duration of the stimulation entered the analysis ($\beta = -0.27$, $t(32) = -1.99$, $P = 0.056$). For DIF, the outcomes showed a somewhat reversed pattern: when correcting for coffee consumption only, the effect was

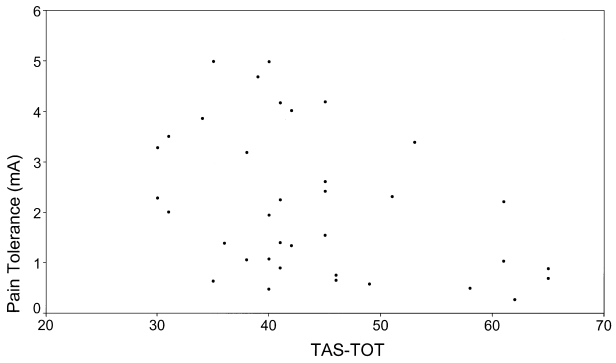

Fig. 1. Partial scatterplot of the total Alexithymia score (TAS-TOT) and Pain Tolerance.

marginally significant ($\beta = -0.28$, $t(34) = -1.76$, $P = 0.087$), whereas after additional correction for sensory threshold and duration of the stimulation, the association reached the traditional level of significance ($\beta = -0.27$, $t(32) = -2.15$, $P < 0.04$).

4. Discussion

In the present study, alexithymia was inversely related to pain tolerance and, to a lesser extent, to pain threshold (the latter was true only for one facet of alexithymia, namely externally oriented thinking, and only when not corrected for sensory threshold, which was significantly correlated with both variables). Together with previous findings regarding the association of alexithymia with a variety of somatic complaints (Taylor et al., 1992; Cohen et al., 1994; Lumley et al., 1997), the present results suggest that alexithymia is associated with enhanced sensitivity not only to internal (somatic) unpleasant sensations, but also to externally induced pain. This conclusion is in line with the hypothesis that general hypersensitivity to (unpleasant) physical stimuli, either proprioceptive or externally administered, underlies, at least partially, the higher levels of somatic complaints in individuals scoring high on alexithymia. It should be noted, however, that this hypothesis should be further examined using other types of unpleasant stimuli and sensations, since only one type (electric current) has been used in the present study.

Although in a previous study (Sivik, 1993), alexithymia was also found to be associated with enhanced pain sensitivity (palpational stimulation), clear conclusions of those results were obscured by remaining methodological questions. In another study on the relationship between alexithymia and pain sensitivity (De Zwaan et al., 1996), no associations were obtained. However, the respondents in that study were primarily patients with eating disorders. In addition, only pain threshold (at which point the stimulation stopped) was investigated, and not pain tolerance, which in the present study appeared to be the most sensitive variable. It may be speculated that enhanced sensitivity in persons scoring high on alexithymia may become more pronounced during high intensity stimulation or after a prolonged pain stimulation period (the trials in the present study lasted on average 4–8 times longer than those in De Zwaan et al.'s study). The latter possibility is in agreement with the suggestion of Lumley et al. (1996b), that especially chronic somatic sensations may be amplified by alexithymics.

The underlying mechanism for the association between alexithymia and enhanced sensitivity to painful stimulation remains largely unclear. It has been suggested that alexithymic individuals may have a dysfunction in the limbic system, which is rich in opiate-binding sites (Flannery, 1978). An alternative view is that alexithymic individuals have a relatively greater left hemisphere dominance and right hemisphere deactivation (Kaplan and Wogan, 1976). Kaplan and Wogan (1976) showed a positive association between experimentally induced larger activity in the left hemisphere, accompanied by a lower activity in the right hemisphere, and higher experimental pain ratings. More recently, alexithymics have been demonstrated to have a preference for conjugate lateral eye movements to the right, suggesting a relatively greater reliance on the left hemisphere and neglect of the right hemisphere (Parker et al., 1992). On the other hand, for non-emotional stimuli, evidence has been obtained for a bidirectional deficit in communication between the hemispheres in alexithymics, rather than a relative dysfunction of the right hemisphere (Zeitlin et al., 1989). Finally, at another level, negative affectivity, the cognitive tendency to perceive experiences in a negative or even aversive way, may be responsible for the higher pain sensitivity and somatic complaints of alexithymics (Lumley et al., 1996b). Future research should address these important issues with respect to the potentially explanatory mechanisms regarding pain perception and somatization in individuals scoring high on alexithymia.

Besides difficulty identifying feelings, externally oriented thinking was found to be associated with lower pain tolerance. This was not anticipated, given the fact that usually difficulty with identifying feelings and also difficulty communicating feelings have been found to be associated with somatic complaints, but not externally oriented thinking (Lumley et al., 1996a, 1997). Perhaps this specific finding is due to potentially stronger *cognitive-perceptual* aspects involved in processing of pain stimuli, which may also be more important in identification of feelings and thought orientation, as opposed to relatively stronger *communicative* aspects involved in self-reports of somatic complaints, which are presumably also more important in the communication of feelings.

The limited number of participants in the present study is the major reason for prudence regarding interpreting the present results. In addition, the fact that the study was conducted among (healthy) psychology students brings up the question of limited generalizability. Although the present sample consisted of part-time (evening) students, making the sample considerably more heterogeneous

regarding age and employment situation than a sample of regular students, future research with more representative samples of the general population is recommended. Alexithymic tendency should be regarded as a continuous personality dimension rather than a present-or-absent characteristic (Taylor et al., 1991), which makes the construct suitable to be studied in healthy non-clinical samples. However, the often demonstrated association of alexithymia with somatic complaints described above warrants an extension of the here applied approach to specific samples of pain and somatoform patients.

In summary, in the present study it has been found that individuals scoring high on a validated self-report measure of alexithymia have a higher pain sensitivity (especially lower pain tolerance) than low alexithymia scorers during self-administered pain. Taken into account previous results on the relation between alexithymia and self-reported somatic symptoms, alexithymia seems to be associated with enhanced sensitivity to both internal (somatic) unpleasant sensations and externally induced pain. This conclusion points at the possibility of a general hypersensitivity to unpleasant physical stimuli associated with alexithymia. In future studies, different types of unpleasant stimuli should be applied in different study samples. In addition, the focus should also be on potential mechanisms underlying these associations.

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