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Interoceptive accuracy in patients with Medically Unexplained Symptoms (MUS)

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Background:

In previous research on healthy persons, we found that high symptom reporters and persons with negative emotions were less interoceptively accurate, especially in contexts containing negative, symptom-related cues. In the present study, accuracy of respiratory symptom perception was tested in a clinical female sample with MUS and a matched (age, BMI, and SES) healthy control group.

Method:

Participants (N = 58) were told that they would inhale different gas mixtures that might induce symptoms. Next, they went through two trials of the Rebreathing Test. One trial consisted of a baseline (60s), a rebreathing phase (150s), and a recovery phase (150s); in the other trial, no recovery phase was inserted. During each trial breathing behavior was continuously monitored, and subjective sensations were rated every 10s. Within-subject correlations were calculated between the subjective rating and its physiological referent for the rebreathing phase and recovery phase of each trial separately.

Results:

MUS-related differences did not emerge during the rebreathing phases, but, consistent with previous findings, MUS patients were significantly less accurate than controls in the recovery phase.

Conclusion:

This patient study corroborates earlier findings, showing that high MUS reporters have lower interoceptive accuracy compared to controls in contexts containing negative, symptom-related cues, but only during weak (recovery) and not during strong (rebreathing) symptom inductions.

Lightheadedness and cerebral blood flow

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Background:

The prevalence of pseudoneurological complaints (e.g. lightheadedness) is associated with stress and anxiety. It is hypothesized that stress-induced hyperventilation and a subsequent reduction in cerebral blood flow may cause these symptoms. However, in a previous study (Van Diest et al., 2006), it was shown that lightheadedness could be learned in response to a harmless cue that had previously been associated with hyperventilation. In the present study, we aimed to replicate this finding while measuring cerebral blood flow velocity.

Method:

Two odors (acetic acid and ammonia) served as conditional stimuli (CSs). Hypocapnic overventilation (30 breaths/min) was used as an unconditional stimulus (US) and normocapnic overventilation served in control trials. A learning phase consisted of six (semi-randomized) breathing trials: three CS+ trials (one odor was presented during hypocapnic hyperventilation) and three CS- trials (the other odor was presented during normocapnic hyperventilation). In a test phase, one CS+ and one CS- odor were presented during both a normal breathing and a normocapnic overventilation phase. Throughout the experiment, end-tidal CO₂ (etCO₂), airflow and mean blood flow velocity in the right middle cerebral artery (Vm) were measured, while participants rated their lightheadedness on a computer scale. Following each trial, participants filled in a complaint questionnaire.

Results:

Preliminary results indicated that participants rated more lightheadedness during test-CS+ trials than during test-CS- trials. However, the relationship between etCO₂ and Vm was not different between test-CS+ and test-CS- trials.

Conclusion

These preliminary findings suggest a learning effect on perceived lightheadedness, but not on cerebral blood flow.

Is Perceived Stress associated with the susceptibility to Upper Respiratory Illness (URI) in early adolescents?

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Background:

The aim of the study was to investigate whether the level of perceived stress is associated with greater incidence and symptom severity of URI in early adolescents.

Method:

Early adolescent participants (N=210, age 10-12 yrs, in Lima, Peru) went to through psychological testing. Their parents were interviewed in their homes by trained psychologists about respiratory antecedents, stressors of their children, environmental risk exposure conditions, parental predisposition to URI and socioeconomic status. Trained nurses at school checked common cold frequency during 4 months between June and November 2006. Allergic and asthmatic children (N=100) were excluded from the sample and are analyzed separately. One year later the same data will be re-collected with the same sample.

Results:

High levels of stressful life events and its impact on the children was significantly related with a higher frequency of common colds during the following 4 months.

Conclusion:

Our first results replicate in early adolescents the relationship between the number and impact of life events and the predisposition to get common colds.

Cardiorespiratory responses of self-injurious eating-disordered patients to experimentally induced pain

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Background:

The level of physiological distress during self-injurious behavior is unclear.

Method:

Eating-disordered women (ED; N = 11) with self-injurious behaviour (SIB) in daily life performed both a cold (10°C) and a warm (36°C) pressor test on separate occasions. Self-reported pain intensity and unpleasantness, heart rate and respiration were continuously measured.

Results:

A subgroup of patients not experiencing pain during SIB (N=7; ED-NP) showed a marked decrease in pain during the 10 °C test and reported a reduction in tension following the 10 °C test only. These effects were not observed for another group with self-reported pain during SIB (N = 4; ED-P). The ED-NP group scored higher on dissociation and pain re-interpretation/negation than the ED-P group. Across participants, higher pain ratings during the 10°C compared to the 36°C test were associated with more pronounced increases in respiration in the 10 °C compared to the 36 °C pressor test.

Conclusions:

The pattern of results indicates that ED patients without subjective pain during the 10 °C test also failed to show the stress-related ventilatory increase that is typically observed in healthy persons in response to pain.

Relationship of heart rate variability to resting breathing pattern.

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Background:

Most individuals can alter heart rate variability (HRV) amplitude and frequency by deliberately changing their rate and pattern of breathing. And reduced ability of respiration to modulate heart rate is often an early sign of autonomic dysfunction.[1, 2] Changes in lung volume, respiratory and central motor output, chemoreceptor stimuli and diaphragm contraction all play a role in how respiration influences sympathetic output and heart rate variability. [3, 4] It has not been established if resting breathing pattern and habitual diaphragm function has an effect on HRV or a person's ability to modulate their cardiac rhythms. Therefore we tested whether breathing pattern during normal breathing correlated with a persons ability to achieve coherence between respiration and heart rate variability.

Method:

The Manual Assessment of Respiratory Motion or MARM [5] was used to assess breathing pattern in 83 people who suspected they had dysfunctional breathing.

They were asked to perform the Quick Coherence Test. In this test the person is asked to breathe slowly while trying to increase the amplitude and coherence of the wave pattern on the Heart Math Freeze Framer. Heart Math software was used to calculate scores for High, Medium or Low Coherence.

Results:

When testing all individuals (n=83) There was a significant inverse correlation ($p < .01$) between resting breathing pattern and the person's score with the Quick Coherence Test. ($r = -.463$) In people with paradoxical breathing (n=9) there was an inverse relationship between thoracic dominance in breathing and ability to achieve high coherence using the freeze framer. ($r = -.768$).

Conclusion:

Further are needed to confirm this, however this study suggests that a person's resting breathing pattern influences their ability to modulate cardiac rhythms with respiration and this effect is greatest when diaphragm function is abnormal.

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Defense reactions to interoceptive threats: a comparison of loaded breathing with aversive picture viewing

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Background:

Although interoceptive threats play a crucial role in panic disorder, human fear research has mostly applied exteroceptive stimuli to induce experimental fear. This study aimed to investigate the unconditional affective properties of one type of interoceptive stimulus that can easily be applied in the laboratory, i.e., a resistive load added to the breathing circuitry.

Method:

Participants (N = 41) received 15 presentations of each of the following stimuli (randomized): a light load (5cm/H₂O/l/s, presented during one inspiration), a strong load (20cm/H₂O/l/s during one inspiration), aversive pictures (8 s), or no stimulus. An acoustic startle probe was presented in 66% of the trials 500 or 1500 ms following stimulus onset. Measurements included electrodermal activity, startle blink responses, subjective fear and subjective ratings on valence, arousal and dominance.

Results:

The strong load evoked larger electrodermal responses compared to the light load and the aversive pictures. Startle blink potentiation was found during the light load and during aversive picture viewing for the 1500 ms probe. Startle responses to the strong load were not different from those in any other stimulus condition. The strong load differed from all other conditions in valence (more unpleasant), arousal (higher) and dominance (lower) ratings.

Conclusion:

Inspiratory loads evoke a range of attentive and affective reactions comparable or stronger than those evoked by aversive pictures.

Subjective sensations and physiological reactions elicited by 7.5 and 20% CO₂ inhalation: Implications for learning paradigms.

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Background:

Inhalation of CO₂ – enriched air is an interesting unconditional stimulus (US) to apply in fear conditioning paradigms, because its unconditional effects (UR) resemble the topography of human fear and panic responses. An important assumption, however, is that CO₂ inhalation goes unnoticed until its arousal-inducing effects (UR, mainly a ventilatory increase) are subjectively experienced by the participant. The present study aimed to test this assumption.

Method:

In two studies, we investigated the presence and the onset latency of subjective sensations elicited by the inhalation of 7.5% (2 min; N = 36) and 20% (30 s; N = 21) CO₂ – enriched air using a mouthpiece. Also breathing behaviour, electrodermal activity and the eye-blink EMG startle response were measured.

Results:

Approximately half of the participants reported a “taste” and/or “a sensation in the throat” 20 seconds following the start of the 7.5% CO₂ – inhalation. Increases in breathing and breathlessness were reported only 30 seconds later on average, but more participants reported these sensations. Approximately eighty percent of the participants tasted/sensed the 20% concentration after 15 seconds already. Increases in breathing and breathlessness were perceived 10 seconds later, but fewer participants reported these sensations.

Conclusion:

CO₂-inhalation produces a taste/sensation in the throat early on in the trial, before participants perceive an increase in arousal (increased breathing). It is likely that the taste will function as a conditioned stimulus (CS) in fear paradigms using CO₂-inhalation as the US. Implications and future directions will be discussed.

Heart rate variability biofeedback for panic disorder with COPD: preliminary data.

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Background:

Panic disorder is common in patients with chronic obstructive pulmonary disease (COPD). Estimates suggest approximately one-third of patients with COPD experience panic attacks and 25% may meet DSM-IV criteria for panic disorder. Heart rate variability (HRV) biofeedback has been shown to improve functioning and reduce emotional distress during exercise in patients with COPD. The current study tests the use of HRV biofeedback to treat panic disorder in patients with COPD

Methods:

Fourteen patients with COPD and panic disorder were randomly assigned to either a) 6 weekly treatment sessions of HRV biofeedback plus 4 sessions of coached walking or b) the control condition of 6 weekly sessions of pursed lips and abdominal breathing training plus 4 sessions of coached walking. The primary outcomes measure was the Panic Disorder Severity Scale (PDSS) given at pre-treatment, post-treatment and 2-month follow-up. Secondary outcomes included panic attack frequency, six-minute walk test distance, and self-rated disability

Results:

Clinically significant improvements in PDSS score were seen in 4/6 patients in the biofeedback treatment and 1/6 patients in the control condition at post-treatment and again at 2-month follow-up. Secondary outcomes also indicated greater improvement in the HRV biofeedback treatment group.

Conclusion:

Preliminary results suggest that HRV biofeedback may be an effective treatment for panic disorder in patients with COPD.

Preliminary Results of a Psychophysiological Treatment for Patients with Multiple Unexplained Physical Symptoms (MUPS)

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Background:

Multiple Unexplained Physical Symptoms (MUPS) are the most common presentation for depression and anxiety disorders in primary care. The proportion of patients with somatic complaints is estimated to be between 20% and 84%. A more recent report suggests that more than one half of all patients seen in primary care have no diagnosable medical illness. The purpose of this study is to determine whether a psycho-physiological intervention is an effective treatment for patients with MUPS associated with common mental disorders. Psycho-physiological therapies are usually more appealing than psychotherapeutic interventions to patients with unexplained symptoms, who, by definition, tend to think that the problem is in the body, not the mind.

Methods:

Fourteen study participants have completed the study. Eight randomized to an immediate treatment group, while six randomized to a wait-list, where their physician was given written instructions regarding care of MUPS patients, but no biofeedback was offered. The treatment comprised 10 weekly training sessions (approx. 1 hour each) that included muscle relaxation, a structured method of self-hypnosis (autogenic training), and biofeedback (for increasing heart rate variability, controlling breathing, reducing muscle tension, reducing skin conductance, and increasing finger temperature).

Results:

Compared with the wait-list group, treatment subjects showed improvement on illness severity and degree, improvement on depression measures, and improvement on the hyperventilation measure. There were no differences in anxiety measures.

Conclusions:

Psychophysiological treatment reduces symptoms that are largely unexplained. Self-regulation techniques which focus attention to physical symptoms may be especially appealing to MUPS patients.

Body Mass Index and symptom perception in children with asthma

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Background:

Emerging research suggests that a complex relationship exists between asthma and obesity, and that overweight status complicates asthma outcomes, including symptom perception. Some findings (e.g., Sin 2003; Schachter, 2003) suggest that obesity may relate to over perception, though no reports employed a well-validated method for quantifying asthma symptom perception. We employed the Asthma Risk Grid to characterize the relationships between excess weight and asthma symptom perception in children, and evaluated factors that may differentially influence perception in overweight and normal weight groups.

Methods:

Two hundred and forty-seven children with asthma 7 - 17 years old ($X = 12.0$) and a parent completed demographic and asthma questionnaires. Children's subjective and objective peak flow measurements were recorded at home for 5-6 weeks via the AM2 spirometer. AM2 data were summarized using the Asthma Risk Grid (Klein et al., 2004) resulting in 3 scores reflecting the proportion of blows that fall into Accurate, Symptom Magnification or Dangerous Symptom Perception zones.

Results:

Of the 200 children with complete data, 39 (20%) were categorized as overweight ($\geq 95^{\text{th}}$ BMI percentile). Participants at or above the cutoff had significantly lower Accurate scores ($p < .05$) and higher morbidity scores ($p < .05$) than those below the cutoff. The overweight group had higher mean scores for symptom magnification and danger zone, though group differences were not statistically significant. Overweight was not related to hospitalizations or other objective markers of asthma severity. Ethnic minority status was significantly related to overweight ($p < .01$) and poorer perception (p 's $< .001$).

Conclusions:

Overweight status was related to less accurate perception and higher morbidity in a sample of children using a well validated measure of symptom perception. While neither the specific pattern of over or under perception of symptoms was significantly related to overweight, the results suggest further study is warranted. Findings related to ethnic minority status indicate another avenue for future research.

Heart Rate Variability (HRV) Biofeedback for In Vivo Endotoxin-induced Systemic Inflammatory Response

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Background:

Injection of lipopolysaccharide (LPS), an inflammatory cytokine, produces a systemic inflammatory response, flu-like symptoms, increased respiration, decreased heart rate variability (HRV). Other research has shown that the inflammatory response is associated with decreased vagal tone. HRV biofeedback is known to increase vagus nerve function.

Methods:

Six healthy young adult study participants were given four pre-LPS sessions of HRV biofeedback training, and trained to breathe at their resonant frequencies. Five placebo subjects were trained to do paced breathing 15 times per minute. Participants were administered LPS (2ng/kg, CC-RE, Lot #2) over a one minute-period through a peripheral intravenous catheter. Endogenous cytokines, respiration, heart rate variability, and symptoms were assessed every hour for 12 hours, and then again at 24 hours after LPS exposure.

Results:

Compared with placebo, biofeedback subjects showed less photosensitivity, and higher resting HRV. There were no differences in endogenous cytokine response.

Conclusions:

HRV biofeedback reduces symptoms and autonomic sequelae of LPS exposure. It may be useful for controlling symptoms after surgery. It does not appear to affect the inflammatory response.

Respiratory changes as a function of flight task difficulty among experienced pilots in a Boeing 737B flight simulator

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Background:

This research was done in order to determine whether psychophysiological recording can improve prediction of flight task work load, over a commonly used self-report measure, NASA's TLX.

Methods:

Seven experienced pilots were given 18 flight tasks of about 5 minutes each, rated *a priori* by FAA staff as having low, medium, or high task load. We measured respiratory variables using a Vivometrics LifeShirt. We also tested subjects in a maximal stress task, a "plain vanilla" baseline, and a 6/min breathing task.

Results:

Respiration rate, inspiratory flow rate, and minute volume ventilation all increased during tasks producing high work load. Multiple regression analysis showed that minute volume ventilation significantly increased prediction of flight task difficulty over that done by the TLX. ETCO₂ was measured on four subjects. *In all cases*, the task for each subject with the lowest task performance score was accompanied by a task-minimum ETCO₂ value of <32 mm Hg. In three of the subjects the tasks with the lowest evaluator score showed minimum ETCO₂ readings below the subject's median. ETCO₂ was unrelated to *a priori* ratings of flight task difficulty, however.

Conclusions:

Ventilation changes in relation to flight task difficulty. Occasionally hyperventilation occurs, which appears to impair performance.

Hyperventilation During Wakefulness and Sleep

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Background:

Idiopathic Hyperventilation is a poorly understood condition of sustained hypocapnia and controversial aetiology (Jack *et al* 2004). Chronic anxiety and some evidence of clinical depression are also present in this condition.

It has previously been shown that hyperventilation and sustained hypocapnia persist during moderate to severe intensities of exercise. We therefore hypothesised that this sustained drive to breathe would be abolished in slow wave sleep where there are minimal cortical influences on control of breathing.

Method:

We studied 10 patients with a mean age \pm SD of 50.8 ± 12.5 years. Idiopathic Hyperventilation defined as normal cardiac, respiratory and endocrine function and sustained hypocapnia during mild- moderate intensity exercise. $P_{ET}CO_2$ at rest and peak exercise was 25.4 ± 3.37 and 27.7 ± 6.35 respectively.

Full polysomnography was performed with continuous monitoring of nasal $P_{ET}CO_2$ (mmHg). During wake $P_{ET}CO_2$ was 32.7 ± 4.79 , light sleep 34.0 ± 4.9 , slow wave sleep (SWS) 35.0 ± 3.66 and REM sleep 34.15 ± 3.95 mmHg. Baseline respiratory rate was 18.9 ± 6.0 breaths/minute and hospital anxiety and depression scores were 11.6 ± 3.95 and 8.7 ± 2.0 respectively

Results:

There was a trend towards a positive correlation during wake and SWS ($r=0.6$). There was however a significant correlation between breathing frequency during wake and breathing frequency during SWS ($r=0.79$) and during wake and REM ($r=0.95$).

Conclusion:

These data suggest that although this condition may be initiated by psychological factors that the sustained hypocapnia observed both during moderate intensity exercise and SWS is not sustained by these factors. Mechanisms controlling this state may be due to the continuation of respiratory personality in non- behavioural sleep (Shea *et al* 1989) and suggests that this condition may be due adaptation and plasticity of the respiratory system.

Parental Perceptions of Asthma Control in Children: The Role of Parental Fear

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Background:

The concept of “asthma control” is increasingly recognized in guidelines for asthma management. Some assessments (e.g., the Asthma Control Test) use self or parent ratings of asthma control as a component of the algorithm to determine overall disease control, however this rating may be influenced by emotional factors. We assessed what factors predicted parents’ response to the question, “How well controlled is your child’s asthma?”, in a sample of ethnic minority families.

Method:

126 caretakers (96% mothers; 87% Latino, 13% African-American) of children with asthma participated as part of a baseline assessment for a culturally-tailored asthma management intervention. Seventy-one percent had annual incomes below \$20,000 USD. Parents completed measures of asthma symptoms (Asthma Assessment Form), a general survey about health care utilization and asthma’s impact on the family, and the asthma control test (ACT), which included the parental report of perceived asthma control.

Results:

We utilized regression models to evaluate the independent contributions of parental report of asthma symptoms and activity limitation (Step 1), ER visits and hospitalizations in the past year (Step 2), and parental fear due to asthma (Step 3) in predicting parental ratings of asthma control. In the final model, report of symptoms was the strongest predictor of parent-rated control ($\beta = -.27, p < .001$), however parental fear due to asthma predicted additional variance in ratings of asthma control ($\beta = -.19, p < .05$). Health care utilization history was not associated with control ratings.

Discussion:

Parental fear due to asthma was associated with ratings of children’s asthma control, independent of symptoms and health care utilization history. This suggests that emotions may play a role in parental assessments of disease control. Future research is needed to assess the relationships among parental anxiety, disease management practices, and perceptions of asthma control.

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Disentangling anxiety from panic in self-reports of fear

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Background:

Autonomic fear responses vary along a continuum ranging from defensive attention and immobility ('anxiety') to overt action or 'fight or flight' ('panic'). The present study aimed to explore to which extent 'anxiety' can be discriminated from 'panic' in *self-reported* fear responses.

Study 1

In a first step, participants (N = 60) rated 90 affective responses (not only fear responses) to the extent they would experience each of the responses in 15 prototypical 'cued anxiety', 'panic' and 'generalized anxiety' situations. To uncover the situation-response profiles, the situation x response x person matrix was subjected to a hierarchical classes analysis (HICLAS; De Boeck & Rosenberg, 1988), yielding a series of hierarchical classes models of increasing complexity or rank. The solution in rank 2 revealed a clear distinction between responses associated with the generalized anxiety situations on the one hand, and responses linked to cued fear (panic/cued anxiety) situations on the other hand.

Study 2

In a second step, 22 responses that were specific for cued anxiety, panic or generalized anxiety situations were selected from the 90-responses pool from Study 1. Sixty other participants rated these on 3 prototypical 'panic', 3 'cued anxiety' and 3 'generalized anxiety' situations. The HICLAS-analysis showed that certain self-reported responses were specific for 'panic' situations (sweating, breathing deeper, tense muscles, fear of dying, derealization, pounding heart, breathing faster), whereas others for 'cued anxiety' (alertness, thinking clear and sharp, to startle, sharpened senses) and still others for 'generalized anxiety' (sadness, irritation).

Conclusion:

Preliminary evidence indicates that not only physiological, but also self-reported fear responses are able to discriminate between 'cued anxiety' and 'panic'.

Breathing modification in asthma: effects on airways physiology and on anxiety

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Background:

There is a growing body of evidence suggesting breathing modification techniques may improve symptoms and reduce bronchodilator use in asthma. The mechanism of effect is debated, with suggestions on the one hand that reducing hyperventilation and hypocapnia may improve objective asthma severity and on the other that such techniques are in effect an elaborate placebo having indirect effects through psychological mechanisms.

Methods:

Within the context of a randomized controlled trial investigating physiotherapist supervised breathing retraining, we assessed physiological and psychological parameters before and after intervention.

Results:

183 symptomatic adult asthmatics were randomised to 3 sessions of physiotherapist supervised breathing training (n=95) or an asthma nurse delivered educational 'control' programme of 3 equivalent sessions (n=89). Improvements in asthma control were seen in both groups, with asthma-related quality life improvements greater with breathing retraining. Significant improvements in 'Hospital Anxiety and Depression Questionnaire' anxiety scores were seen in both groups without significant difference between groups (p=0.68). The Nijmegen Questionnaire (NQ) score reduced significantly following breathing retraining (-5.3, 95% CI -3.8 to -6.9) but also in the Control group (-4.4, -3.0 to -5.6), without significant differences between groups (p=0.29). A stronger correlation existed between changes in anxiety and NQ scores in the breathing training (r=0.50, p<0.001) than in control groups (r=0.22, p=0.04). Minute Volume reduced significantly in both groups, without significant inter-group differences (mean, 95% CI difference -0.57, -2.20 to 1.05L, p=0.49). ETCO₂ and methacholine PC₂₀ did not change significantly within or between groups.

In the breathing training group, there were no significant correlations between changes in asthma control and changes in either end tidal CO₂ (r=-0.19, p=0.06) or minute volume (r=0.19, p=0.07).

Affective modulation of inspiratory occlusion pressure

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Background:

P100 reflects the drop in mouth pressure that is being developed after 100 ms by an inspiratory attempt against a closed breathing circuit. It is a little investigated, fast phasic measure of the momentary 'central respiratory drive'. The present study aimed to explore inspiratory occlusion pressure (P100) during affective picture viewing.

Method:

Healthy women (N=78) viewed four pictures series (160s) varying in affective content: neutral, positive, threat and pain. They also rated each picture series on pleasantness and arousal. A 100 ms occlusion was applied at the onset of inspiration in 1 out of 3 breaths.

Results

The threat and the pain picture series were associated with an increased P100 and were rated as most unpleasant and highest in arousal.

Conclusion:

P100 is affectively modulated and may constitute a suitable and interesting measure to apply in emotion research.

Respiratory variability and sighs

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Background:

Respiratory variability is typically found in healthy subjects, whereas breathing with a constant volume can cause atelectasis. Evidence suggests that sighing may function as a physiological resetter in order to stimulate correlated variability in the respiratory system when breathing becomes too strained. Conversely, sighing may reset the respiratory system when uncorrelated random variability in the breathing pattern increases and respiratory short term memory decreases. This study explored respiratory variability before and after sighs in adults during awake state.

Method:

Breathing data were collected during a 20-min. baseline period of quiet sitting before participating in a study involving noise stress. Four blocks of ten breaths with 50% window overlap were constructed before (block 1 to 4) and after (block 5 to 8) sighs and non-sighs. Total respiratory variation of each block was calculated by the coefficient of variation (CV) of minute ventilation. Respiratory short term memory of each block was determined by the autocorrelation (AC) of minute ventilation at one breath lag.

Results:

Before and after a non-sigh, no differences were found in CV, nor in AC. Towards a sigh, CV increased and AC remained equal. During the block before (block 4) and after (block 5) a sigh, both CV and AC strongly increase, whereas from block 5 onwards CV gradually decreases. Also AC decreases strongly from block 5 to block 6 to baseline level and remains stable in the subsequent blocks.

Discussion:

These results suggest that prior to a sigh, uncorrelated random variation increases, whereas after a sigh, autocorrelation strongly increases. These results are consistent with the hypothesis that sighing may be functional to reset respiratory short term memory.

Sighing during periods of stress and relief

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Background:

Sighing has been related to both stress and relief. In a previous study, we found more sighing during relief than during stress periods. In two experiments we aimed to replicate these findings and examine the influence of the presence of a stressor preceding the stress or relief period.

Method:

In Experiment 1, participants were subjected to 60 successive trials. Each trial consisted of two phases: a cue phase (10s) followed by a stressor phase (10s). During the cue phase, a danger signal predicted exposure to an 85dBA white noise during the stressor phase, whereas a safety signal predicted silence. During the cue phase situations of stress and relief were created, both either following a noise stressor or following silence. Breathing parameters were recorded continuously. In Experiment 2, participants were subjected to two blocks of 20 trials. The design was identical, except for the duration of the cue and stressor phases, each of which varied unpredictably from 5 to 50 seconds .

Results:

Mean number of sighs during the cue presentation were analysed in a repeated measures anova with type of cue (danger vs safety) and the presence of a preceding stressor (yes vs no) as within subjects variables. In Experiment 1, the mean number of sighs during safety periods were higher than during danger periods. Data analysis of Experiment 2 is in progress.

Conclusions:

These results suggest that more sighing occurs during periods of relief compared to stress periods. In a stressful context, sighing may be functional to relieve tension when a stressor ends or is anticipated not to come.

Interrelationships between the perception of dyspnea, pain and negative affect

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Background:

The perception of dyspnea shows many similarities with the perception of pain, e.g. aversive character, alarm function, motivational aspect and cortical processing. However, research comparing both sensations is still rare. Moreover, some theories of emotions emphasize the role of the interoception of physiologic sensations for the development of emotions. Therefore, the present study examined the interrelationships between the perception of dyspnea, pain and negative affect.

Method:

In fourteen healthy participants (mean age: 26.3 years) dyspnea was induced by inspiratory resistive load breathing whereas pain was evoked during a cold-pressure-test. A negative affective state was induced by watching a respective picture series with pictures from the International Affective Picture System (IAPS). Unpleasantness and intensity of perceived dyspnea and pain were measured in each condition with separate visual analog scales (VAS). Affective valence and arousal during picture viewing were assessed with the Self-Assessment Manikin (SAM). Respiratory parameters (inspiratory time, breathing frequency), heart rate (HR) and/or respective ratings (VAS, SAM) confirmed successful experimental manipulation in all three conditions.

Results:

Perceived unpleasantness of dyspnea correlated significantly with perceived unpleasantness of pain ($r=.45$) and with negative affective arousal ($r=.56$). Unpleasantness of pain showed marginal correlations with negative affective arousal ($r=.39$), valence ($r=-.37$) and HR ($r=-.41$) during the picture series. Perceived intensity of dyspnea and pain were not correlated and only weakly associated with negative affective valence.

Conclusions:

The results suggest particular associations in the unpleasantness-dimension between the perception of dyspnea and pain. They further support theories emphasizing the role of the interoception of physiologic sensations for the development of negative affect.

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Attentional distraction reduces the unpleasantness of dyspnea during exercise in patients with COPD

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Background:

Dyspnea is the primary symptom limiting exercise in patients with chronic obstructive pulmonary disease (COPD). Recent research has shown that psychological factors can substantially impact on the perception of dyspnea, but little is known about the modulation of perceived intensity (sensory dimension of dyspnea) or unpleasantness (affective dimension) of dyspnea by attentional distraction. Therefore, the present study examined the influence of distractive auditory stimuli on the perception of exercise-induced dyspnea and affective state in patients with COPD during 6-min walking tests (6MWT).

Method:

Twenty patients with mild-to-severe COPD (mean age: 65 years; mean FEV1%pred=55.9) performed two 6MWTs in counterbalanced order across patients. Under one exercise condition distractive auditory stimuli were presented with headphones, while the other condition was performed without auditory distraction.

Lung function (FEV1), heart rate (HR), arterial oxygen saturation (SpO₂), perceived intensity and perceived unpleasantness of dyspnea were assessed before and after both 6MWTs. In addition, the global level of dyspnea (Borg-score), and positive and negative affectivity (PANAS) were measured after both exercise conditions.

Results:

A similar level of exercise intensity during both conditions was confirmed by comparable results in FEV1, HR, SpO₂ and distances walked. During auditory distraction, Borg-scores and increases in perceived unpleasantness of dyspnea were smaller while positive affectivity was higher compared to the non-distraction condition ($p < 0.05$). Perceived intensity of dyspnea did not show differences across conditions.

Conclusion:

The results suggest that attentional distraction with auditory stimuli decreases the global level of exercise-induced dyspnea in patients with COPD by reducing the perceived unpleasantness of dyspnea. This is associated with an additional increase in positive affectivity. Auditory distraction might therefore serve as an intervention for the reduction of dyspnea during exercise in this patient group.

The language of dyspnea in patients with COPD at different intensity levels of dyspnea

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Background:

Verbal descriptors of dyspnea have been suggested as being important in understanding the underlying pathophysiology, but little is known about the language of dyspnea in chronic obstructive pulmonary disease (COPD). Therefore, the present study examined verbal descriptors of dyspnea in patients with COPD at different intensity levels of dyspnea.

Method:

Verbal descriptors of dyspnea were assessed in 64 patients with mild-to-severe COPD (mean age=62 years, mean FEV1%pred=54.1) during slight dyspnea at rest (mean Borg score: 1.8), moderate dyspnea during cycle ergometer exercise (mean Borg score: 3.1) and somewhat severe dyspnea during a 6-min walking test before (mean Borg score: 4.2) and after a 3 week pulmonary rehabilitation programme (PR) (mean Borg score: 3.5). In addition, the influence of age, gender, baseline lung function (FEV1%pred) and PR on the verbal descriptors were examined.

Results:

A hierarchical cluster analysis demonstrated that patients differentiated between five clusters of verbal descriptors of dyspnea: heavy/fast breathing, shallow breathing, obstruction, work/effort and suffocation.

These clusters were related to the intensity level of dyspnea but were not related to age, gender, baseline lung function or PR. While shallow breathing was predominant only during slight dyspnea at rest heavy/fast breathing and to a lesser extend work/effort became more important during moderate and somewhat severe dyspnea during exercise. The clusters heavy/fast breathing and work/effort showed the highest sensitivity in discriminating between different intensity levels of dyspnea and in characterizing the positive effects of PR.

Conclusions:

The present results suggest that verbal descriptors of dyspnea in COPD are related to the intensity level of dyspnea. The clusters heavy/fast breathing and work/effort seem to be particularly sensitive descriptors of dyspnea during exercise in COPD.

Cued versus uncued online rating of perceived breathlessness during repeated hypercapnic challenges

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Background:

Online rating of perceived breathlessness (air hunger) in the rebreathing test is a new and powerful technique to analyze the psychological and physiological processes related to the mechanisms of air hunger. The aim of the present study was to assess the influence of the rating method on both air hunger ratings and respiratory behavior during repeated hypercapnic exposures.

Method:

Sixty-one healthy women performed three rebreathing trials. One half of the sample was auditorily cued to rate air hunger intensity every 12 sec (CR, N = 30), the other half was instructed to rate air hunger each time they perceived a change in air hunger intensity (UCR, N = 31). Ventilatory responses to the hypercapnic challenge were measured continuously.

Results:

The CR group yielded an earlier V_T threshold than the UCR group. Only in the latter group, changes occurred across rebreathing trials: the V_T threshold decreased, the RR threshold increased and the sensitivity of the RR increased.

Conclusions:

Different types of air hunger ratings in the rebreathing test cause differences in respiratory behavior, probably through the role of attentional processes.

Air hunger perception and ventilatory response to repeated hypercapnic challenges: Comparing Read (1967) original and modified rebreathing test

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Objective:

The aim of this study was to compare perceived breathlessness (air hunger) and ventilatory behavior in two standardized rebreathing methods, namely Read original and modified rebreathing test (RT and MRT, respectively).

Methods:

Perceived air hunger and the ventilatory response (end tidal PCO₂, tidal volume, respiratory rate) to hypercapnia were continuously assessed during three subsequent rebreathing trials (intertrial interval, ITI = 15 min) in healthy women. One group (N=30) performed the RT, another the MRT (N=23).

Results:

The sensitivity of the respiratory response to CO₂ did not differ among the tests. However, in the MRT, both state anxiety and air hunger were substantially lower and air hunger was more weakly related to respiratory measures compared to the RT.

Conclusions:

The results show that voluntary hyperventilation prior to the MRT has important effects on air hunger perception and the aversiveness of the test, but not on ventilatory behavior.