Blood pressure in women presenting fibromyalgia as a function of pain and avoidance disparities.

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Abstract

Objective: To investigate the relationships between dimensions of PTSD and clinical everyday pain, physiological adaptation to a sub maximal test, i.e. moderate intensity exercise in terms of systolic blood pressure (SBPR) in women with fibromyalgia (FM), and to compare the result to a gender- and age-matched healthy control group.

Materials and method: Twenty-two women presenting FM and twenty-six healthy women were education- and age-matched. All the women completed questionnaires regarding background, Impact of Event Scale-Revised (IES-R) and the short form health related quality of life instrument SF 36. All the women performed a stepwise load increment submaximal exercise test on a cycle ergometer to the severe perceived exertion level. Systolic blood pressure (SBPR) pressure was recorded before, during and after the test.

Results: In comparison to healthy women, the women presenting FM showed higher IES-R values of intrusion, avoidance and hypertension and a tripled impact from clinical pain over 4 weeks. During recovery from the test, the successive decrease in SBPR was smaller in women presenting FM. In both groups the SBPR domain and IES-R domain presented intra correlation. In FM, a correlative link concerned avoidance and SBPR from baseline and through the test. In parallel, hypertension was correlatively linked to SBPR during recovery from the test. Clinical pain correlated with blunted SBPR responses through the test and also during recovery from the test.

Conclusion: Both FM and PTSD are known to mirror suboptimal resources in dimensions such as avoidance, hyper-arousal and different ANS regulatory resources. This situation may be manifested by an interplay avoidance and hypertension and SBPR where in turn, both a vigorous a SBPR response and vigorous SBPR recovery after the test relates to less clinical pain. Further examinations regarding this blunted dynamic and clinical pain together may unfold the role of various agents on resting values and response versus recovery, respectively.

Keywords: Late-onset psychosis, Late-paraphrenia, Dementia, Capacity.

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Introduction

Fibromyalgia (FM) presents a pain syndrome without an established etiology. The diagnosis is based on the criteria developed thoroughly by the American College of Rheumatology which beside the spread of pain throughout the body includes pain duration (>3 months) and the localization of so-called tender points (≥ 11/18 tender points) [1]. In Sweden, 2-3% of the population is affected, with also a clear predominance in women [2].

The symptom profile of post-traumatic stress disorder (PTSD) includes persistent re-experience of the trauma, avoidance of reminders of the trauma and an ongoing physiological arousal [3]. In parallel, Luxenburg et al. [4] point to the situation that the diagnosis of PTSD is best fitted to the exposure to single incidents and non-interpersonal traumas. Polack et al. [5] referred to putative risk factors for developing PTSD in terms of subtle executive functioning deficits that stands in the way of lessening reactivity to trauma relevant stimuli and avoidant coping strategies. Avoidant coping is repeatedly documented in adults presenting FM [6-10] and by Wentz et al. [7] also specified in terms of absorption by activities "keeping busy". Concerning psychological functioning in women with FM as compared to healthy women, Wentz and Archer [10] found significant contrasting PTSD symptomatology values from the Impact of Event Scale Revised (IES-R) with doubled or tripled scores concerning intrusion, avoidance and (psychological) hypertension in women presenting FM. These findings were paired with lower Positive Affect values, higher Negative Affect values, and a correlative link between PA and NA with a sharp contrast with the functioning of healthy women.

Häuser et al. [11] recorded prevalence of 43% regarding PTSD in FM but identified also temporal links between PTSD and fibromyalgia symptoms. Besides psychological functioning and temporal links, similarities between PTSD and FM also concern dysfunctional physiological adaptation to stressors. In both FM and PTSD the autonomic nervous system (ANS) has been found to be more "fixed" when compared to healthy volunteers [12-14]. This fixed pattern of the ANS in PTSD also concerns an unchanged HR from day to night [15] while FM implies patterns of sustained blood pressure from day to night a s.c. circadian "non-dippers" pattern [16].

Co-morbidity of FM with PTSD, physiological similarities between FM and PTSD, self-regulatory difficulties concerning, e.g. avoidance shared between FM and PTSD, the inverse relationship between blood pressure and pain sensitivity that concerns FM and healthy adults together implying that psychological functioning in FM need to be mirrored together with physiological adaptation measures by new and thoughtful sets of measurements.

Aim

The main purpose of the present study was to investigate the relationships between dimensions of PTSD and clinical everyday pain, physiological adaptation to a sub maximal test, i.e., moderate intensity exercise in terms of Systolic BPR and to compare the result to a gender- and age-matched healthy control group.

Material and Methods

Participants

Twenty-five women presenting FM were recruited from primary health care and rehabilitation centers in the region of Västra Götaland (Sweden) all of whom had expressed as interest in participating in the study. The healthy control group was recruited primarily from employees (volunteers) within the health care service, but was complemented with other volunteers in order to obtain for the distribution of age and education level to match that of the women with FM. The age match was made pairwise ± 3 years. For a more detailed description of participants refer to the studies of Lange et al. [12]. Inclusion criteria were female participants, aged 20-60 years with a registered FM diagnosis within the last 7 years. Exclusion criteria were prior trauma to the head, brain damage, severe somatic disease, muscular disease, heart disease or anemia, dependent in personal activities of daily life as well as drugs affecting the heart rate.

The healthy control groups were required to confirm their healthy status, and the same exclusion criteria as for the FM patients were used, with one addition: prolonged pain (Table 1).

Study design

This was a cross-sectional study comparing two groups and is part of a larger longitudinal study, "Affective, cognitive and defensive interplay in fibromyalgia: from premorbid strain to treatment of somatic manifestations".

Table 1. *Demographic characteristics among FM patients and healthy controls. Values are given as mean ± standard deviation (SD), median (range) and number (percentages).*

	FM (n=24)	Reference group (n=26)	p-value
	mean ± SD	mean ± SD	
Age (years)	49.4 ± 9.8	48.7 ± 9.0	0.799
BMI (kg/m)	27.3 ± 6.0	25.1 ± 3.0	0.113
Pain duration (years)	12.7 ± 9.6	NA	
Education (n=22/25)			0.967
≤ 9 years	1 (4.5%)	1 (4%)	ns
9-12 years	5 (22.7%)	6 (24%)	ns
>12 years	16 (72.7%)	18 (72%)	ns

BMI: Body Mass Index; NA: Not Applicable; NS: Not Significant

Ethics

The study protocol that also included an aerobic submaximal exercise ergometer test was approved by the Regional Ethical Review Boards at the University of Gothenburg and consequently designed according to the Declaration of Helsinki, revised 1983. Informed consent was obtained in writing from all the participants and sent to the research group prior to the examinations. An additional permit was passed by the Regional Ethical Review Boards at the University of Gothenburg prior to analysis of blood pressure data for publication specifically.

Procedure

The attending physician for each woman presenting FM was contacted to confirm the FM diagnosis and to certify their appropriateness for inclusion in the study. Demographic data was collected along with questionnaires such as Health related quality of life (SF-36) and Impact of Events Scale-Revised that was sent to the home of each participant. Thereafter the participants were assigned to a rehabilitation center to perform a submaximal exercise test where also their body weight and height were registered (for details se Lange et al. [12].

The submaximal exercise test including the variety of measurements is described in detail in Lange et al. [12]. In short, the participants performed a stepwise load increment submaximal exercise test on an electronically-braked cycle ergometer to the very hard exertion level. The testing was conducted in the afternoon at least 3 hours after the last meal or coffee and the participants were asked to avoid smoking prior to the test. Before the exercise test, HRV was recorded over 5 min during a supine rest. HRV was recorded using a Polar RS 800CX heart rate monitor (Polar electro, Kempele, Finland) that performs HRV recordings [17]. HR and blood pressure were measured after 10 min of supine rest. Blood pressure was further registered in a position of sitting on the ergometer prior to performance. HR was registered from the heart rate monitor and blood pressure was taken manually with stethoscope (Littmann Classic II S.E., 3M, St. Paul, Minnesota) and sphygmomanometer (Welch Allyn, Inc., Skaneateles Falls, New York, USA). HR, blood pressure and rating on the Borg RPE scale (rating of perceived exercions) was collected during the submaximal test that started at a

workload of 25 W and was increased with 25 W each 4 min. When the subject responded with a score of 17 (very hard exertion) on the Borg RPE scale, she was asked to carry out the remaining minutes at the present workload if possible [18]. Directly after the test, the subjects had 20 min of supine rest during which HR and blood pressure were measured repeatedly during 20 min and HRV was recorded for the last 5 min. Blood pressure was registered at 3, 5, 10 and 20 min after the test.

Instruments

IES-R: The Impact of Event Scale-Revised (IES-R) measures the intensity of complaints during the last 7 days in the dimensions: Intrusion (IES-R I) (8 items), Avoidance (IES-R II) (8 items) and Hyper arousal (IES-R III) (6 items). The response alternatives range from 0 to 4. From the Swedish short manual is learned that IES-R concerning PTSD is not a diagnostic instrument but instead indicates current level of complaints, the intensity of symptoms and change in these regards [19]. The use of cut off scores is not recommended [20] but a mean score of 1.89 at one subscale indicates disturbance and a mean score of 1.8-2.0 for the whole scale indicates PTSD. On the scoring sheet the question on which Event the ratings concerned was changed into the plural form Events.

Pain: To assess health related quality of life in the dimension of pain the Short-Form 36 (SF 36) was used. All the scales range between 0 and 100 where a higher value represents a higher estimated quality of life [21], implying that concerning the sub-scale Bodily Pain (BP) a low level of pain is indicated by a higher value and vice versa. The sub-scale, BP, is composed by two items concerning pain during the last four weeks reflecting level of pain and interference from pain, respectively. The SF-36 has been showed to be an appropriate instrument for assessing quality of life in women with FM [22].

Analysis of data

Originally the BPR recordings were among the safety measures surrounding the submaximal ergometer tests. Parallel the recordings were included in the test protocols together with BMI, height, HR, etc. Due to the signification of the BLPR recordings, they became uneven concerning DBPR. Especially during the phases of increasing workload sitting on the ergometer the recordings were very sparse and therefore excluded from the present analysis. The number of physiological variables was further restricted through formation of BPR sum variables concerning firstly two different baseline values in terms of resting or sitting at the ergometer together with BPR at three successive levels of workload (25, 50 and 75 W) SBPRbas3. Secondly, the down regulation of SBPR at 3, 5 and 10 min after the test formed the variable SBPRdown3. The differences between women presenting FM and healthy controls concerning systolic blood pressure SBPRbas3 and SBPRdown3 and the measures IES-R I, II and III and a EIS-R mean from all three dimensions together with the pain index of SF-36 BP was examined using one-way ANOVA.

A correlation concerning SBPRbas3, SBPRdown3 and IES I, II, III and EIS-R mean, was carried out for women presenting FM and healthy controls separately and respectively. In order also to determine the relationship between predictor variables and SBPRbas3 and SBPRdown3 a linear regression analysis, using the enter method with SBPRbas3 and SBPRdown3 as the criterion variables, was performed. The predictor variables were chosen among the variables where the correlative pattern of women with fibromyalgia significantly differed from that of healthy women. The analyses were performed for the study group presenting FM. A further consideration was that both groups retained an acceptable size (around 15 participants) through the calculations. The level of significance was 0.05 two-tailed.

Results

Nineteen women presenting FM and 20 healthy women completed all subscales of the IES_R. Fourteen women presenting FM and 2 healthy women scored above 2.0 points at one or more subscales. As seen in Table 2, when compared to healthy women, women presenting FM showed pronouncedly higher IES-R values in terms of intrusion, avoidance and hypertension. Furthermore, SBPR at baseline and during three levels of work load (SBLPRBas3) did not differ between the groups. Concerning successive decrease in systolic blood pressure during recovery at 3 min, 5 min and 10 min after the test was termed SBLPRdown3 the successive decrease was smaller in women presenting FM. The health related quality of

Table 2. *The effect of group in terms of women presenting Fibromyalgia (FM) and healthy women (HW) on psychological and physiological measures: Impact of Event scale-Revised (IES_R) on three dimensions of Post-traumatic Stress Disorder complaints.*

I=intrusion, II=avoidance, III=hypertension and an IES-RTot=a mean sum score. The sum variable of systolic blood pressure during baseline resting and sitting at the ergometer and during 25 W 50 W and 75 W work load was termed SBPRBas3. A sum variable that embraced the successive decrease in systolic blood pressure during recovery at 3 min, 5 min and 10 min after the test was termed SBLPRdown3. The Health Related Quality of life Short Form (SF-36) scale mirroring interference from sub optimal health during 4 weeks in terms of Bodily Pain (BP). Means (with standard deviation presented in brackets) concerning all measures and single items

Measures BPR	FM M (SD)	HW M (SD)	Df within groups and between groups	F-value	P value
IES_R I	2.51 (1.02)	1.30 (0.90)	1,40	16.148	0.000**
IES_R II	2.03 (0.84)	1.03 (0.98)	1, 38	10.903	0.002*
IES_R III	2.24 (1.11)	0.72 (0.78)	1, 40	25.050	0.000**
IES_R Mean	2.27 (0.91)	1.06 (0.81)	1, 37	19.225	0.000**
SBPRbas3	505.82 (53.71)	487.87 (50.71)	1, 38	1.166	0.287
SBPRdown3	26.60 (25.15)	46.23 (20.69)	1, 44	8.436	0.006*
Bodily Pain BP	25.27 (14.59)	81.90 (16.65)	1, 41	140.968	0.000**

**p<0.001 *p<0.01

life dimension BP showed a pronouncedly lower value (more clinical pain during 4 weeks) in women presenting FM. The effect of group on all values except for SBLPRBas3 reached at least level of significance where $p \leq 0.01$.

In, women presenting FM, the correlative links concerned all IES-R measures and the two BPR measures respectively. Accordingly, correlation between intrusion, avoidance and hypertension and the IES-R mean score showed high values (Table 3) and the correlative value between the baseline plus three levels of workload BPR value of SBPRBas3 with the recovery measure SBPRdown3 showed a high value. Beyond these "intra-class" associations, in women presenting FM significant correlations concerned everyday pain, psychological functioning and physiological recordings; avoidance implied lower SBPR through the test and psychological hypertension implied lower successive BPR recovery from the test. A lower level of clinical pain (BP) implied higher successive BPR recovery after the test a greater similarity to healthy women in both the pain and the blood pressure dimensions.

In healthy women, the correlative links were limited to either the three IES-R subscales or the two BPR measures. Accordingly, correlation between intrusion, avoidance and hypertension and the IES-R mean score showed high values (Table 4) and the baseline through three levels of workload value of SBPRBas3 together with the recovery measure SBPRdown3 showed a high correlative value.

A linear regression analysis enter method was performed concerning women presenting FM with SBPRbas3 as the criterion variable and Post Traumatic Stress Disorder complaint; avoidance (IES-RII) as predictor. A significant multiple regression equation was found F (1, 13)=6.943, p=0.021. An adjusted R square explained 30% of the variance in SBPRbas3 from avoidance (IES-RII). The predictor avoidance (IES-RII) reached significant Beta values of -0.590 with a p value of 0.021.

A linear regression analysis enter method was performed concerning women presenting FM with SBPRdown3 as the criterion variable and BP as predictor. A significant multiple

Table 3. *Correlations between Impact of Event scale-Revised (IES_R) on three dimensions of Post-t Stress Disorder complaints.*

I=intrusion, II=avoidance, III=hypertension and an IES-RMean=a mean sum score with the sum variable of systolic blood pressure during baseline resting and sitting at the ergometer and during 25 W 50 W and 75 W workload termed SLPRBas3 and a sum variable that embraced the successive decrease in systolic blood pressure during recovery at 3 min, 5 min and 10 min after the test was termed SLPRdown3 with also the Health Related Quality of life Short Form (SF-36) scale mirroring interference from sub optimal health during 4 weeks in terms of Bodily Pain (BP) in women presenting fibromyalgia

	IES-R I	IES-R II	IES-R III	IES-RMean	SBPRbas3	SBPRdown3	BP
IES-R I	1 19	0.691** 19	0.891** 19	0.945** 19	Ns 15	Ns 17	ns 19
IES-R II **N**	0.691** 19	1 19	0.720** 19	0.864** 19	-0.590* 15	Ns 17	Ns 19
IES-R III **N**	0.891** 19	0.720** 19	1 20	0.948** 19	Ns 16	-0.513* 18	ns 20
IES-RMean **N**	0.945** 19	0.864** 19	0.948** 19	1 19	-0.527* 15	Ns 17	Ns 19
SBPRbas3 **N**	ns 15	-0.590* 15	Ns 19	-0.527* 15	1 17	0.698** 16	0.518* 17
SBPRdown3 **N**	ns 17	Ns 17	-0.513* 18	Ns 17	0.698** 16	1 20	0.713** 20
BP **N**	Ns 19	Ns 19	Ns 20	Ns 19	0.518* 17	0.713** 20	1 22

Table 4. *Correlations between three dimensions of impact of event scale-revised (IES_R) post-traumatic stress disorder complaints.*

I=intrusion, II=avoidance, III=hypertension and an IES-RMean=a mean sum score with the sum variable of systolic blood pressure during baseline resting and sitting at the ergometer and during 25 W 50 W and 75 W workload was termed SBPRBas3 and a sum variable that embraced the successive decrease in systolic blood pressure during recovery at 3 min, 5 min and 10 min after the test was termed SBPRdown3 with also the health related quality of life short form (SF-36) scale mirroring interference from sub optimal health during 4 weeks in terms of bodily pain (BP) in healthy women.

	IES-R I	IES-R II	IES-R III	IES-R Mean	SBPRBas3	SBPRdown3	BP
IES-R I	1 23	0.662** 21	0.810** 22	0.934** 20	Ns 20	Ns 22	ns 18
IES-R II **N**	0.662** 21	1 21	0.623** 20	0.886** 20	Ns 18	Ns 20	ns 16
IES-R III **N**	0.810** 22	0.623** 20	1 22	0.873** 20	Ns 19	Ns 21	ns 17
IES-RMean **N**	0.934** 20	0.886** 20	0.873** 20	1 20	Ns 17	Ns 19	Ns 15
SBPRBas3 **N**	Ns 20	Ns 18	Ns 19	Ns 17	1 23	0.651** 22	Ns 19
SBPRdown3 **N**	Ns 22	Ns 20	Ns 21	Ns 19	0.651** 22	1 25	Ns 20
BP **N**	Ns 18	Ns 16	Ns 17	Ns 15	Ns 19	Ns 20	11 21

Table 5. *A linear regression analysis using the enter method with the sum variable of two baseline blood pressure values from resting or sitting at the ergometer together with systolic blood pressure at three successive levels of workload (25, 50 and 75 W) SBPRbas3 as the criterion variable and post-traumatic stress disorder complaint; avoidance (IES-RII) as predictor concerning women with fibromyalgia.*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.590	0.348	0.298	37.40077

Table 6. *A linear regression analysis using the enter method with sum variable of the successive decrease in systolic blood pressure during recovery at 3 min, 5 min and 10 min after the test termed SBPRdown3 as the criterion variable and post-traumatic stress disorder complaint; hypertension (IES-RIII) and health related quality of life (SF-36) bodily pain (BP) as predictors concerning women with fibromyalgia.*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.756	0.572	0.515	30.25463

regression equation was found F (2, 15)=10.018, p=0.002. An adjusted R square explained 52% of the variance in SBPRdown3 from the predictor. The BP as the significant predictor reached a significant Beta value of 0.585 with a p value of 0.005 (Tables 5 and 6).

Discussion

From the between group comparison women presenting FM differed from the age and education matched healthy women in terms of pronouncedly higher IES-R values. A doubled score concerned intrusion and avoidance and a tripled score concerned hypertension. Concerning successive retardation of systolic blood pressure during recovery at 3 min, 5 min and 10 min after the test women presenting FM showed a lesser temporal retardation while successive SBPR adaptation to the test manifested similarity between the groups. Women presenting FM showed "a third" of the health related quality of life resource concerning clinical pain.

The correlative analysis showed higher order links inside both the IES-R subscales domain and the SBPR domain. This finding makes women presenting FM and healthy women very alike. Besides this very close resemblance, the correlative examination showed that in women presenting FM the separate domains of psychological and physiological functioning were exceeded by foremost the avoidance subscale of IES-R showing a negative correlative link to the successive physiological adaptation to workload (in terms of SBPRbas3). Besides this, the IES-R subscale hypertension show and a positive link to successive retardation of SBPRdown3 after the test while intrusion lived and worked outside the physiological recordings. Moreover, in women presenting FM a lesser experience of clinical pain was correlatively linked to both SBPRbas3 and SBPRdown3 Regression analysis implied firstly that more avoidance meant an ineffectual response in terms of SBPR to the test. Secondly, a lower level of clinical pain in FM implied a more vigorous decrease in SBPR after the test.

Several of the symptoms expressed in FM seem associated with 'dysautonomia', e.g. the widespread pain, insomnia, irritable bowel, etc., which has prompted analyses of spontaneous fluctuations of the heart period and systolic pressure featuring elevated sympathetic control, reduced vagal modulation and lower cardiac baroreflex sensitivity [23,24] several of these expressions implicate decreases/ dysregulation of parasympathetic activation and loss of heart rate variability [25].

Blood pressure in chronic pain and FM

Duscheks et al. [26] concluded that the inverse relationship between blood pressure and pain sensitivity was equally valid across the whole blood pressure spectrum (ranging from hypotension to hypertension). This conclusion relied upon a pioneer comparison between hypotensive and normotensive study groups and according to Wentz and Archer [27] this dynamic embraces also the condition of FM. From public health perspectives, Hagen et al. [28] found that a high systolic and diastolic BPR was associated with a 10% to 60% lower prevalence of chronic musculoskeletal complaints irrespective of the anatomical site of pain gender or age group.

From healthy adults, Black et al. [29] documented that post-exercise (stress arousal) blood pressure was associated with a generalized inhibitory pain mechanism. In contrast, Wentz and Archer [30] found that aerobic sub-maximal ergometer exercise test resulted in an increase in pain from the test in women presenting FM. Similar findings on the relationship between pain and exercise in FM were made by Kosek et al. [31] and Vierck et al. [32].

PTSD and FM

Researchers have documented repeatedly the associations between FM and both early and adult life stressful experiences, e.g. Walker et al. [33]. Further progress regarding PTSD in FM was made by Hellou et al. [34] who underlines the significance of the less violent form of child abuse in terms of neglect in development of FM also recording a 37.3% prevalence of Post-Traumatic Stress Disorder (PTSD) among FM patients. The comorbidity between FM and PTSD has been repeatedly established by e.g. Häuser et al. [11], Sherman et al. [35], Cohen et al. [36] or Coppens et al. [37].

Concerning expression of pain in FM and physiological measures, Figueroa et al. [23] found that 16 weeks of resistance exercise training decreased the myalgiac scores and that the change in these scores were positively correlated with the increase in total power of HRV but not with other autonomic variables. In the present result, the absence of links between BP and the IES-R measurements may imply a somewhat non psychological nature of clinical FM pain. Instead, the vigor of both the SBPR response to the test and the SBPR decrease after the test related to less clinical FM pain.

Adversity, stress, cognition, affect and psychophysiology

In women presenting FM, the intertwined dynamics of psychology not principally with pain but instead with physiology emerged from the IES-R scores because avoidance related to less the vigor of the SBPR response to the test. In addition, the IES-R Hyper arousal score related to less potency of the SBPR decrease after the test. Concerning these dynamics explanatory power may be extracted from Wentz and Archer [10] regarding psychological functioning, health related quality of life and work ability in women presenting FM. Women presenting FM contrasted to healthy women while firstly in FM the IES-R dimensions not being related to the level of Vitality. Secondly, in FM avoidance related (positively) to current workability while thirdly in FM avoidance implied less resources in everyday life from emotional causes. Fourthly, in FM the strikingly low vitality scores being unrelated to workability. Fifthly, in FM the negative affectivity (NA) score was very high and the positive affect (PA) score poor meaning that a lower PA values and higher NA values induced severe psychological strain in FM and sixthly in FM PA and NA floating together (being moderately correlated). This evidently different interplay of psychological (and health related quality of life) functions in FM may offer illumination regarding the psychological and the physiological findings in the present results. Obviously, avoidance plays a cooling off role regarding both PA and NA. (Avoidance was unrelated to the affect life also in healthy women.) In addition, avoidance safeguards workability (tentatively by cooling off the affect life whereas vitality may occur independent of being negatively influenced by avoidance in FM. In women presenting FM the costs of avoidance could be rated as low. Thus, avoidance appears as a compensating resource in terms of executing an ancient form of cognitive affective control in terms of the posterior Cingular cortex that is the limbic cortex or the cortex of the mammalian brain. What may be controlled are limbic structures including the amygdala, the Septum with also relevance for the Nucleus Accumbens and not least physiological responses. This suggested dynamic may from a cognitive affective perspective elucidate the restraint on SBPR during the test that accompanies avoidance. Literally, apart from the suggested dynamics of the posterior Cingular cortex the IES-R III dimension hyper-arousal is accompanied by a blunted SBPR decrease after the test logically referring to the physiological reflection of IES-R III hyper arousal. In parallel to the inferred brain function in avoidance, the hyper-arousal dimension of PTSD is associated with an impaired pre frontal cortex functioning according to Arnsten et al. [38]. In parallel, Riva et al. [39] have interpreted an increased resting heart rate in terms of a central attenuation of the major stress systems in FM. This latter interpretation may also be relevant regarding increased resting values regarding both SBPR and diastolic BPR presented by the current study group with FM [40].

The above hypothesized chain of events may be further supported by work on BPR reactivity of Ohira et al. [41] who found that long term stress (at work) implies less activity in brain regions related to higher order cognitive functioning (executive functioning) relying more on habit action also off-work. Furthermore, during laboratory stress this was accompanied by diminished cardiovascular reactivity. A reduced connectivity between the brain and cardiovascular activities was suggested by these researchers. Regarding FM, links between FM and traumatic life histories are repeatedly established [7,8,33,34]. From the perspective of traumatic experiences, Lovallo et al. [42] examined the psychological and physiological reactivity and laboratory stress in 354 young healthy adults and found that adverse experiences predicted smaller heart rate and cortisol responses to the stressors. Furthermore, the blunting effect on physiological functioning was dose-dependent in terms of number of adverse events. Also, Voellemin et al. [43] found an attenuated laboratory stress response in young healthy women with adverse childhood experiences. Attenuated reactivity of the hypothalamic-pituitary adrenal axis and the cardiovascular system was dose dependent in terms of number of adverse experiences.

Conclusion

Taken together, FM and PTSD seem to mirror suboptimal resources in dimensions such as avoidance, hyper arousal and different ANS regulatory resources. In FM this situation is manifested by an interplay between the PTSD dimensions of avoidance and hyper arousal and SBPR measures in turn involved in the level of clinical pain in that way that less pain relates to increase in SBPR but also to increased successive SBPR recovery after the test. Thus, low pain thresholds relate to lower BPR and lower BPR recovery. Based on the present result further examinations regarding this blunted dynamic and clinical pain together may take off from suggested various agents on resting values and response versus recovery, respectively.

Limitations

An obvious limitation in the present study is the scarcity of DBPR measurements. This is due to BPR measurements not from the start being intended for analysis and publication. They were instead made as an accommodation for the participants. It ought to be indicated that the patient group was confined to 25 patients due to the administrative contingency. For this study only these patients were available.

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