

To assess pressure pain threshold in young healthy females during examination stress

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ABSTRACT: From the time of conception, stress is present in human life (1). Stress either physical or psychological can induce neural, endocrine and behavioural responses and depends on personal relevance. Generalized nociceptive hypersensitivity and alterations in pain sensitivity in stress is determined by pressure pain threshold (PPT) measured by the algometer. **aim and object** of the study is to evaluate the relation of stress and pain in healthy young medical girls students by observing the changes in the PPT (pressure pain threshold) of different groups of muscle of upper limb during the examination stress. **Materials and Methods:** Study was conducted on 30 healthy young girls medical students of 1st year in the department of physiology, Ruhscmsjaipur. Subject group were examined 15 days before the examination and one day before the examination. PPT of the dominant upper limb muscles eg Triceps, Biceps and dorsum of hand. **RESULT:** Pressure pain threshold (PPT) of the biceps and hand muscles have a significantly positive correlation with the acute stress of examination than the triceps muscles which have a non-significant correlation. P value of biceps and hand muscles and triceps muscle is (0.003) and (0.000) and (0.112), respectively. **Discussion:** Increased pain sensitivity in the examined muscles is due to disinhibiting central nervous system structures involved in regulation of attention eg:- ascending reticular activating system, HPA axis, brain neuronal activity resulting in sensitization of nociceptive neurons and in enhanced pain sensitivity. **conclusion:** acute stress of examination modulates pain in humans and contributes to individual variability in pain affect and pain-related brain activity.

Keywords : Pressure pain threshold (PPT), HPA Axis –hypothalamic –pituitary adrenal axis, nociceptors, algometer, hyperalgesia, allodynia.

.INTRODUCTION :

Stress is a common phenomenon to all of us in the modern world, when we think e.g. job deadlines of exams etc. The relationship between stress and pain is complex. Acute effects of stress on pain perception are somewhat ambiguous. Both have adaptive functions and try to protect the organism in case of harm and danger. International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience of a body sensation associated with actual or potential tissue damage, or described in terms of such damage (2) external stress such as academic examination have a potential impact on sensitivity of muscle of deep tissue. Previous studies show that exposure to psychosocial stresses may cause alterations in pain sensitivity to pressure determined by pressure pain threshold and generalized nociceptive hypersensitivity can be detected (3,4,5,6) pain stimulation is used in several established laboratory for stress tests. PPT measurement by the algometry is objective, reliable, simple, and noninvasive evaluation of the relation of stress and pain. The phenomenon of stress-induced analgesia is well documented in animal research and individual variability in the stress response in humans may produce corresponding changes in pain. Stress can activate sympathetic nervous system and the hypothalamus-pituitary-adrenal (HPA) axis, which causes the release of glucocorticoids (GCs) into the bloodstream. GC binds with GR, (glucocorticoid receptors) it translocates into the nucleus where it initiates gene transcription. Revollo and Cidlowski, reveals that acute stress can produce this optimal level of GCs, whereas in chronic stress the increased level of GC (7) the length of

GC/GR interactions causes detrimental changes egdownregulate transcriptional activity ,induce structural plasticity in the CNS, and causes neuropathic pain that can be characterized by the presence of allodynia, and hyperalgesia, an exaggerated response to an already painful stimulus. In humans, recent findings indicate that acute stress response involves large-scale reorganization of the brain networks responsible for the regulation of vigilance and sensory processing, including the anterior mid-cingulate cortex (aMCC), the fronto-insular cortex and subcortical regions (Hermans et al., 2011)(8)“Vyas et al.(2002) showed that chronic immobilization stress (two hours per day for 10 days) induced dendritic atrophy in CA3 pyramidal cells in the hippocampus,(9) The Alexander et al. (2009) also explored the idea that NMDA receptors play a role in stress-exacerbated nerve injury-induced neuropathic pain (10). Administration of the GR antagonist and NMDA receptor antagonist prior to acute restraint stress in mice diminished injury-induced allodynia that proves the mechanism of stress induced pain sensitivity. many studies suggest that acute stress is likely to regulate the pain-related brain responses and the perception of pain(8)

AIM AND OBJECT of the study is to assess in healthy young medical girls students the changes in the PPT (pressure pain threshold) of different groups of muscle of upper limb during the examination stress..

MATERIALS AND METHODS:

Study was conducted on 30 healthy young girls medical students of 1st year in the department of physiology ,Ruhscmsjaipur. age range was 18 and 22 years. all the subjects were free from any muscle pain etc .informed consent was obtained from all subjects prior to start of the study .

Procedure:students are examined twice on each day. following parameter were assessed height, weight, BP, pulse, measurement of PPT of tricep, biceps, and dorsum of hand were carried out by using pressure algometer. pain sensitivity was carried out on the dominant arm. all the measurement were taken by a single examiner and subject was instructed to be relaxed during the examination and no information about the aim was given to the subject to avoid observational bias.

Algometer measurement :pressure algometry measurements were performed by an electronic algometer to assess PPT of tricep, biceps, dorsum of hand .the subject group were examined 15 day before the examination and one day before the examination. Examination is considered as the source of stress .the PPT was determined as the point at which the subject sensed a change from a pressure to a feeling of pain. the tip of algometer with a surface of 1 mm square is applied to the skin and ppt were assessed on muscular sites on triceps, biceps and dorsum of hand . average 3 reading were taken on each site and mean value was taken of all 3 successive readings. reading is noted in range of algometer is 0-145 kpa. The PPT measured in respect of a muscle does not only refer to the pressure sensation on the muscle, but also as a measure of sensitivity to the feeling of pressure on the skin.

OBSERVATION:This study was done to evaluate the influence of stress and anxiety on the pressure pain threshold of upper limb muscle, 30 healthy girls medical students of 1st year Ruhscmsjaipur were stressed into this study before they undertook an academic examination. the subject group were examined 15 day before the examination and one day before the examination and compared .statistical analysis was done by the spss-22 software .the mean age,height,weight of the subjects was 19.6 ± 0.932 years , 5.250 ± 7.268 feet and 45.7 ± 11.40 kg. respectively as mentioned in table -1. systolic and diastolic blood pressure and pulse were measured and statistical analysis was done by the spss software .pressure pain threshold (PPT) value of different muscle of the dominant hand is calculated at two sitting first 15 day before the examination and second at one day before the examination. mean and standard deviation is calculated and compared by using paired t test and p value is calculated. As shown in the table -2 and 3. table -2 shows the finding that systolic blood pressure is significantly decreased but diastolic blood pressure is increased in the post period (1 day before). Pulse rate is non significantly decreased in the post period. ppt value of the biceps and hand muscles were significantly decreased in post period but ppt of triceps is non significantly decreased., table-3 shows ,there is a significantly

negative correlation is present of systolic and diastolic blood pressure with stress at pre and post period ..and non significant relation of pulse is present. biceps and hand muscles have a significantly positive correlation but the triceps muscles have a non significant correlation with stress in pre and post period.

Table-1

Parameter	mean	Std .Deviation
Age (years)	19.6	±0.932
Wt.(kg)	45.75.	±11.40221
Height(feet)	5.250333	±7.268

mean ± std deviation of normal parameters

Table-2

paired sample statistics

S. N.	Parameters	15 day before exam (pre)		1 day before exam (post)	
		mean	std. deviation	mean	std. deviation
1	BP(systolic) mm of hg	118.80	±9.412	115.20	±8.892
2	BP(diastolic) mm of hg	72.97	±7.289	75.87	±6.124
3	Pulse	90.63	±14.85	89.300	±14.1644
4	Biceps (PPT)	42.567	±8.2365	39.167	±6.5394
5	Tricep(PPT)	41.500	±6.5482	38.967	±8.5237
6	Hand (PPT)	42.33	±9.557	38.53	±9.557

mean ± std deviation of different parameters at two time of examination .

Table 3 Paired sample test

S.N.	Parameters	paired differences			p value	significance
		15 day before exam(pre)	1 day before exam(post)	mean (paired)		
		mean ± std deviation	mean ± std deviation			
1	BP(systolic) mm of hg	118.80±9.412	115.20±8.892	-3.400	.000	sig
2	BP(diastolic) mm of hg	72.97±7.289	75.87±6.124	-2.900	.000	sig

3	Pulse	90.63±14.85	89.300±14.1644	1.3333	.083	non sig
4	Biceps(PPT)	42.567±8.2365	39.167±6.5394	3.400	.003	sig
5	Triceps(PPT)	41.500±6.5482	38.967±8.5237	2.533	.122	non sig
6	Hand(PPT)	42.33±9.557	38.53±9.557	3.800	.000	sig

RESULT: This study was done to evaluate the influence of stress and anxiety on the pressure pain threshold of upper limb muscle, 30 healthy girls medical students of 1st year ruhsmsjaipur were included into this study before they undertook an academic examination. Informed consent was obtained from all subjects prior to start of the study. Age range was 18 and 22 years. All the subjects were free from any muscle pain. The subject group were examined 15 days before the examination and one day before the examination. On each day we assessed the following parameters: height, weight, blood pressure, pulse and pressure pain threshold (PPT) of arm muscles including biceps and triceps, and muscle of dorsum of hand by using pressure algometer. Statistical analysis was done by the SPSS-22 software. The mean age, height, weight of the subjects was 19.6±0.932 years, 5.250 ±7.268 feet, 45.7±11.40 kg, respectively as shown in table-1

Normal physiological parameter and PPT value of arm muscles were compared 15 days before (pre) and 1 day before (post) the examination. In the table -2 mean ± std deviation of all the parameters is mentioned and in the table -3 values are compared by using the paired t test and p value is calculated.

The systolic blood pressure is significantly decreased from (118.80±9.412) mean±std deviation to (115.20±8.892) but diastolic blood pressure is increased from (72.97±7.289) mean±std deviation to (75.87±6.124) in the post period. P value is (.000) of both systolic and diastolic BP and it is negatively significant with the stress in pre and post period. Pulse rate is decreased from (90.63±14.85) mean±std deviation to (89.300±14.1644) in the post period. P value is non significant (.083). PPT value of the biceps and hand muscles were significantly decreased in post period from (42.567±8.2365) mean±std deviation to (39.167±6.5394) and from (42.33±9.557) to (38.53±9.557) respectively. P value of biceps and hand muscles is positively significant with stress in pre and post period i.e. (.003) and (.000) respectively. PPT of triceps is decreased from (41.500±6.5482) mean±std deviation to (38.967±8.5237) and P value is non significant (.112) with the pre and period of stress.

DISCUSSION :

Previously many studies are done to evaluate the effect of stress on the PPT on different muscles of the body. In this study we try to find out the influence of stress and anxiety on the pressure pain threshold of arm muscles: biceps and triceps and muscle of dorsum of hand. The pressure algometer is broadly used in research to assess deep tissue sensitivity for pain perception in different muscle. Examination period is taken as a psychological stress by the students and to prove the relationship between psychological stress and pressure pain sensitivity of muscle study is conducted on the female medical students of first year. Pressure pain threshold (PPT) of arm muscle is measured during different time of examination (15 days and 1 day before exam) at all sites. In our study little attention has been paid to the

perceptual response of the arm and hand muscles of the dominant side. It has been emphasized that the validity of stress response in human subject is strongly influenced by the type of stress stimuli and the degree of personal relevance. In our study students are undergoing in academic examination that is longlasting stressful condition have a potential impact on sensitivity of muscle of deep tissue. Lower level of PPT is observed during just one day before the of examination may be due to more stress at last moment of examination. Our result support the relationship between psychological stress and pressure pain sensitivity of muscle. Previous studies also hypothesize that stress include neural, endocrine and behavioural responses. The neural response is activation of the sympathetic nervous system, resulting in release of epinephrine and norepinephrine (11) whereas the endocrine response involves stimulation of the hypothalamic-pituitary-adrenal (HPA) axis (12). The behavioural responses include increases in pain threshold (13) increased pain sensitivity in the examined area is by disinhibiting central nervous system structures involved in regulation of attention. eg:- ascending reticular activation system. This disruption may result in hypervigilance, dysfunctional reactivity of the hpa axis resulting in a relative hypocortisolism. Koltzenburg et al (16) Chrousos et al and Herrero et al (14,15) have same findings as in our study. There is increased pain sensitivity during stress. It is hypothesized that different mechanism eg. hypocortisolism, increased sensitization of nmda receptors on central neurons, ongoing sensitization of nociceptive neurons and the wind-up of spinal cord neurones causes enhanced pain sensitivity.

Asma Hayati AHMAD and Rahimah ZAKARIA study the Pain in times of Stress and found That stress system does not functions alone; the genetic and psychological makeup of a person, experience and environmental factors all affect this. (17)

Vidal & Jacobs, (1982) study on animals reported stress induced hyperalgesia (SIA) following non-noxious stress in the rat. (18),

Gameiro, et al (2006) study found that hyperalgesia can be attributed to the fact that repeated exposure to stressors leads to the release of endogenous opioids, resulting in over-activation and desensitization of opioid receptors (tolerance) tolerance to the analgesic effects of opioids is associated with hyperalgesia and is related to increased activity of n-methyl-d-aspartate receptors (19,20,21,22)

The study conducted on high job strain persons (23,24) and on 308 Danish office workers (4) reported decreased PPT measurements among participants with persistent stress as compared with non-stressed employees. There is lower PPT values in the trapezius, the supraspinatus as well as the tibia in men as well as women.

Study done on 26 opera singers to assess the acute stress response before, during and after a performance and founds the same increased PPT (3)

Another study finds that hypersensitization plays a part in many chronic pain disorders such as fibromyalgia syndrome (fms), which has been associated with substantial decrease in pain threshold (25,26)

Some studies showing the result that there are some changes occur at the CNS level 18,19,20,21,27 and there is overactivation of the hormonal stress-response system as a result of ongoing strain often leads to down-regulated adrenocortical responsiveness characterized by relative primary adrenal hypocortisolism with increased feedback inhibition of the hpa axis. (Heim, et describe the potential role of hypocortisolism in the pathophysiology of stress-related bodily disorders. (28)

A study done by Etiennevachon-Presseau et al and Coghill et al founds that acute stress contributes to individual differences in pain and pain-related brain activity in healthy and chronic pain patients. (29,31)

Bornhövd et al.(2002)found in a single-trial fmri study that painful stimuli evoke different stimulus-response functions in the amygdala, prefrontal, insula and somatosensory cortex: (30)

Maixner shows relation between sensitivity of patients with painful temporomandibular disorders to experimentally evoked pain(32)

It has been shown that anxiety exacerbates pain through activation in the hippocampus (33)

Quintero et al.demonstrated that hyperalgesia due to an inescapable subchronic stress is resulted from diminished central 5-HT activity (35)

Chronic stress has been shown to attenuate dopaminergic activity in the nucleus accumbens, resulting in hyperalgesia (34)A study using positron emission tomography (PET) showed that psychological stress in humans causes mesolimbic dopamine release(36)Using pain as the stressor, another PET study showed that basal ganglia dopaminergic activity is involved in pain processing, as well as emotional processing of the pain stimulus (37)Nigrostriatal D2 dopamine receptor activity was related to the sensory aspect of pain, whereas mesolimbic D2/D3 dopamine receptor activity was related to negative affect and fear. This finding outlines the regions involved in the physical and emotional responses to painrelated stress in humans.

AmbraMichelotti,in 2000 founds decreased Pressure-Pain Thresholds of the Jaw Muscles During a Natural Stressful Condition in a Group of Symptom-Free Subjects (38) The contradictory finding are present in the study done by Kholoud S. AlGhamdi, in2009"Effect of stress on pain perception in young women" and found that Various types of physical and mental stressors significantly increased PPT by Activating intrinsic pain suppressive mechanisms of the brain.(39)

CONCLUSION :Pshycological stress of examination is a subjective and emotions perception depend on genetic and psychological makeup of a person. acute stress of examination modulates pain in humans.there is hyperalgesia but in some previous studies there was analgesia effectdue to activation of opoid analgesic system.Duration of stress is mainly modify the mechanism. Activation of reticular activating system and disinhibiting HPA axis responsible for hyperalgesia or increased pain sensitivity..

CARRY ON MESSAGE:

In our study we suggest for future work to observe the pain sensitivity in different type of stress(physical and psychological) estimation of the glucocorticoids level and the brain imaging during the stressfull situation is helpful for evaluation of the relation of stress and pain sensitivity.

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