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RESEARCH ARTICLE

Comparative study of response to experimental cold pain in dysmenorrheic and nondysmenorrheic women

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ABSTRACT

Background: There has been keen research interest into the gender differences in tolerance of pain sensation. Dysmenorrheic pain is common among women of reproductive age group. Assessment of pain perception will result in better management of this chronic state. In this era of personalized medicine, optimizing analgesic treatment in patients with chronic pain is essential. **Aims and Objectives:** To compare levels of pain threshold and pain tolerance determined using cold pressor test in dysmenorrheic and nondysmenorrheic women during a single menstrual cycle in different phases. **Materials and Methods:** This is a comparative study done on 31 dysmenorrheic and nondysmenorrheic women between the ages of 18 and 22 years conducted in a tertiary care institution. We performed cold pressor test on 1st, 14th, and 21st day of menstrual cycle denoting the menstrual phase, late follicular phase, and luteal phase on the participants. **Results:** The levels of pain tolerance and pain threshold were significantly higher in dysmenorrheic women in comparison to nondysmenorrheic women. **Conclusions:** Higher thresholds may be supportive of a model of pain adaptation as dysmenorrheic women tend to compare cold pressor pain with internal menstrual pain. The knowledge of varying pain perception would benefit the gynecologists in dose adjustments of analgesics.

KEY WORDS: Cold Pressor Test; Pain Threshold; Pain Tolerance

INTRODUCTION

The International Association for the study of pain conceptualized the definition as "pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."[1] Pain is a multidimensional emotional experience affecting quality of life resulting in tremendous financial losses as well as human suffering across all age groups from infants to elderly, of either gender across ethnic lines and cultural boundaries. The perception of pain has two important elements, the sensory discriminative and affective-motivational which are carried by two different nociceptive projections running in a parallel and in a complementary manner to each other.[2,3]

Possible sex differences in responses to experimentally induced noxious stimulation have been explored by experimental studies such as different pain induction modalities and measurement protocols. Techniques of pain induction have included pressure, electrical, thermal, mechanical, cold pressor, and other forms of noxious stimulation.[3] The results of the previous experiments to differentiate between "pain" from a woman's perspective and "pain" from man's perspective remains inconclusive. The

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contrast in subjectivity of pain tolerance is affected by coping skills, motivation to withstand the pain and energy level which establishes the concept of pain adaptation model.[4]

Due to their short and painstaking reproductive function, women are more vulnerable than men to various circumstances that can trigger pain responses, such as dysmenorrhea, pregnancy, and childbirth.[5] Dysmenorrhea is a common problem in women who form a major work force and contribute to economic loss to society due to both absenteeism and reduced productivity.[6]

The evaluation of pain perception in humans would contribute significantly in understanding mechanisms, methods of control and pain management in physicians which would yield in potential benefits of pain relief in patients. In this study, we evaluated the pain threshold and pain tolerance levels in women with dysmenorrhea and without dysmenorrhea.

Objective of the Study

To compare levels of pain threshold and pain tolerance determined using cold pressor test in dysmenorrheic and nondysmenorrheic women during a single menstrual cycle in different phases.

MATERIALS AND METHODS

Design

Cross-sectional study.

Participants

This was study conducted in the Department of Physiology in Vydehi Institute of Medical Sciences and Research Centre. The subjects who volunteered to be a part of the study were provided informed consent and the study was conducted as per the Institutional Ethical Committee guidelines. We included medical students from the age group 18 to 22 years. Group I consisted of 31 women with history of dysmenorrhea. Group II consisted of 31 healthy women with no history of dysmenorrhea.

Inclusion Criteria

Nulliparous and unmarried females from the age group 18 to 22 years with regular menstrual cycles of 25-30 days length for last 3 months without history of any on-going hormonal treatment were included. The criterion for dysmenorrheic women was clinical history of cramping pain for the past 3 months requiring medications.[7]

Exclusion Criteria

The subject should not be currently on any pain relieving medications. Past history in exclusion included trauma or bone fractures in the nondominant hand; tingling, numbness sensation in the hands. Those with suggestive symptoms of urogenital pathology such as lower back pain and burning micturition were excluded.[7]

Study Procedure

A circulating water bath (designed locally) was used to immerse the nondominant hand of the subject (palm down, up to 5 cm above wrist level). Water was maintained at 0°C-2°C using crushed ice.[7] A calibrated clinical thermometer was used to measure the temperature. CPT was performed on three separate occasions with each subject; on days 1, 14, and 21 of the menstrual cycle assuming that typical menstrual cycle lasts 28 days.[7] This is based on the rationale that the follicular phase begins on the 1st day of menstrual cycle and lasts 10-14 days. About 22-36 h before ovulation, a peak in estradiol level occurs, followed by a peak in luteinizing hormone level 10-12 h before ovulation. The phase after ovulation is called the luteal phase, which lasts for 14 days. Pain threshold (time after which subject reported feeling pain) and tolerance (time for which the subject tolerated the pain) were measured in seconds using two separate stop watches. Pain rating (the intensity of pain felt during CPT, on a scale of 0-10) was obtained from the subject on a visual analog scale after the experiment.[7]

Statistical Analysis

Descriptive and inferential statistical analysis were done using SPSS version 15. Results on continuous measurements acquired using Student *t*-test for quantitative variables with mean ± standard deviation (SD) (min-max) and results on categorical measurements presented in percentage (%). Significance was assessed at 5% level of significance. Independent analysis of variance used to find the significance of study parameters between three or more groups of patients, *post-hoc* Tukey test had been used to find the pairwise significance. Student *t*-test (two tailed, dependent) was used for continuous variables.

RESULTS

This study is a cross-sectional comparative study between 2 groups, 31 dysmenorrheic women, 31 nondysmenorrheic women. Maximum number of subjects was in the age group of 19-20 years in both the groups. Mean age for women was 18.77 ± 1.26 years. The baseline characteristics of both the groups were similar. Cold pressor test was performed on these subjects and their pain threshold, pain tolerance were measured across their menstrual cycle (day 1, day 14, and day 21) for women. Maximum number of subjects was in the age group of 19-20 years in the two groups with a mean age of 18.77 ± 1.26 years.

Pain Threshold

The pain threshold (mean ± SD) was significantly higher in dysmenorrheic women when compared to nondysmenorrheic women across the menstrual cycle. In dysmenorrheic as well as nondysmenorrheic women pain thresholds were least on the 14th day when as compared to 1st and 21st day of the cycle. Table 1 represents the pain thresholds across both groups.

Pain Tolerance

The dysmenorrheic women had significantly higher pain tolerance across the menstrual cycle compared to nondysmenorrheic women. Both the Groups I and II showed the least pain tolerance on day 14, 38.35 ± 7.57 and 45.68 ± 8.00, respectively. Pain tolerance for both the groups was highest for both the groups on day 1. Table 2 represents the pain tolerance across both groups.

DISCUSSION

Research on pain responses in women is gaining importance. Hormonal regulation of pain perception has been studied in detail both in animals and humans in experimental and clinical set up with conflicting data in the literature. Amodei and Nelson-Gray[8] did not find significant differences in pain thresholds and tolerance levels between dysmenorrheic and nondysmenorrheic women exposed to pressure pain in contrast to our study, wherein we observed increased pain threshold in dysmenorrheic women. Hapidou and De Catanzaro[9] measured pain responses to the cold pressor task in 46 normally menstruating dysmenorrheic and nondysmenorrheic women during 2 phases of the menstrual cycle. Visual analog ratings were significantly lower in dysmenorrheic women during the follicular than the luteal phase. Furthermore, these ratings were lower than those of nondysmenorrheic women in the follicular phase. Dysmenorrheic women reported less pain than do nondysmenorrheic women as they compared cold pressor pain with internal menstrual pain. Our results were similar to this study.

Table 1: Comparison of pain threshold across both study groups

Pain threshold (in s)	Group I	Group II	Overall *P* value	Pairwise significance
				Group I-II
1st day	7.10±1.04	4.74±0.68	<0.001**	<0.001**
14th day	5.48±0.68	3.68±0.54	<0.001**	<0.001**
21st day	5.65±0.55	4.03±0.31	<0.001**	<0.001**

**Strongly significant (P<0.01)

Table 2: Comparison of pain tolerance across both study groups

Pain tolerance (in s)	Group I	Group II	Overall *P* value	Pairwise significance
				Group I-II
1st day	58.84±6.69	45.68±8.00	<0.001**	<0.001**
14th day	49.65±6.46	38.35±7.57	<0.001**	<0.001**
21st day	54.35±5.83	42.26±7.54	<0.001**	<0.001**

**Strongly significant (P<0.01)

Bajaj et al., compared modality-specific somatosensory changes during menstruation in dysmenorrheic and nondysmenorrheic women and observed reduced somatosensory thresholds both within and outside areas of referred menstrual pain during the menstrual phase of the cycle in dysmenorrheic women with confirmed ovulation. The results of the study suggested that in dysmenorrheic women, increased afferent barrage from the reproductive organs toward the central nervous system may increase the excitability of somatovisceral convergent neurons in the spinal cord. As a result, the central effect of the input from the somatic tissues within areas of pain referral was amplified, resulting in reduced pain thresholds. This was supported by electrophysiological evidence in animals of spinal cord neurons with convergent inputs from the uterus and the corresponding somatic receptive fields.[10]

Strength of this study was standardized methodology for pain evaluation.

Limitations of our study being the subjective assessment of pain, small sample size, and the lack of hormonal assays for accurate correlation.

CONCLUSION

Pain is a complex phenomenon which is very difficult to measure. The knowledge of pain mechanisms and gender differences would contribute to the pain research and would help in treating pain. The present data showed that pain threshold was significantly higher among the dysmenorrheic women compared to nondysmenorrheic women. This finding may support an adaptation-levels model because they compare cold pressor pain with internal menstrual pain.

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