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A Comparative Study of Pain Thresholds between Diabetic Neuropathy Patients & Non Diabetic Subjects

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Abstract

Background & Objective: Disturbance of sensory function can be a major feature of neurological illness. Objective measurement of the nature and degree of sensory disturbance is needed to understand and characterize the disorder. Among the many sensory modalities pain is the one which attracts the patient to the physician. Pain is a complex sensory experience. Decrease in pain thresholds, increase in magnitude of sensation is useful for the clinician and researcher. Diabetes Mellitus leads to several recognizable clinic-pathological neuropathic syndromes. Diabetic peripheral neuropathy (DPN) likely affects up to one third of adults with diabetes. The current study is designed to evaluate pain thresholds in DPN patients & to compare with non-diabetic healthy subjects.

Materials & Method: Thirty diabetic neuropathy patients & thirty non diabetic subjects in the age group of 35- 60 years were included for the study. Informed consent & IEC was obtained. The pain a threshold was measured by digital algometer. Subjects were instructed to indicate when the pressure sensation begins to hurt, and they first feel pain, which was noted as the pain threshold.

Results: The pain thresholds were significantly higher in DPN (11.74 ± 4.12) kg/cm^2 than in non diabetics (3.02 ± 0.31) kg/cm^2 ($p<0.05$).

Conclusion: Pain threshold is a useful parameter for assessing response to the treatment, but not useful in diagnosis or even as a screening method in diabetic neuropathy patients.

Keywords: *Pain threshold, Algometer, Diabetes Mellitus.*

Introduction

Pain is a complex sensory experience. Disturbance of sensory function is a major feature of neurological illness. Objective measurement of the nature and degree of sensory disturbance is needed to understand and characterize the disorder. Quantification of sensory function can be used to detect disruption of sensory pathways and modify the course and treatment at all levels of the nervous system. Among the many sensory modalities pain is the one which attracts the patient to the physician. Decrease in pain thresholds, increase in magnitude of sensation is useful for the clinician and researcher in evaluation of neurological diseases.

Instrument used to quantify pain sensation is Algometer, used by Head and Holmes to measure pressure pain[1]. Green and Swets described three methods for threshold detection[2]. These methods are now recognized as valuable in testing sensory function and examining the integrity of the small nerve fibers which are not examined by nerve conduction studies. Thus, the recent decade has provided a flurry of reports

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on the clinical use of quantitative sensory testing (QST) in diagnosis, follow-up and evaluation of therapy for many clinical entities. The main clinical applications seem to be the neuropathies and pain-centered disorders.

For clinical purposes, threshold is the function that can most easily and conveniently be measured in non-painful modalities. The rate of diabetes has substantially increased over the past five decades. The most common complication of diabetes is diabetic peripheral neuropathy (DPN). Diabetes Mellitus leads to several recognizable clinic-pathological neuropathic syndromes. DPN likely affects up to one third of adults with diabetes. Hence the current study is designed to measure pain thresholds in DPN patients & to compare with non-diabetic healthy subjects.

Materials & Method

The study was conducted in a sample of forty healthy male subjects and forty healthy female subjects in the age group of 35- 60 years included for the study. Informed consent was taken from all the participants who volunteered for the study.The study was approved by Institutional Ethical Committee.

Inclusion criteria [control Group]:

1. Forty healthy subjects of both sex between 35-60 years.

Exclusion criteria [control Group]:

1. History of consumption of alcohol/smoking.
2. History of depressive disorders in the past.
3. History of sleep disorders
4. History of neurological disorders
5. Hypertension
6. Diabetes mellitus
7. History of consumption of drugs acting on CNS
8. Inclusion criteria [Study Group]:
9. Forty DPN patients of both sex between 35- 60 years.

Exclusion criteria [Study Group]:

1. History of consumption of alcohol/smoking.
2. History of depressive disorders in the past.
3. History of sleep disorders
4. Hypertension
5. History of consumption of drugs acting on CNS

Experimental design: The subjects were selected by a detailed history & thorough physical examination.

Pain threshold was measured by digital algometer. Pain thresholds were measured by delivering gradually increasing pressure stimuli. The pressure at which subject perceives it as pain stimuli will be noted by the change in expression & instructed the subject to raise the hand when he perceives pain. Pain thresholds were measured at different areas. Mean of such six were points was considered as Pain threshold.

Statistical Analysis

The results were expressed as mean ± standard deviation (SD). A p value of <0.05 was considered statistically significant. Statistical analysis was performed using the statistical package for social & sciences. Students unpaired 't' test was applied to compare between the parameters.

Results

Pain thresholds were estimated in thirty healthy non diabetics in the age group of 35- 60 (36.85 ± 4.99) years and thirty DPN patients in the age group of 35- 60 (37.29 ± 4.76) years. Pain thresholds in DPN patients (11.74 ± 4.12) kg/cm^2 were significantly higher at 95% confidence interval than non-diabetics (3.02 ± 0.31) kg/cm^2, $p < 0.001$. The results are shown in the table 1.

Table:1 Comparison of pain thresholds between diabetic neuropathy and non diabetics

	Non-Diabetics	Diabetics	p
Pain Threshold Kg/cm^2 (Mean ± SD)	3.02 ± 0.31	11.74 ± 4.12	< 0.001

Discussion

Pressure algometers are advantageous for quantifying the pressure pain thresholds. Algometer is used for the evaluation of pain, the determination of therapeutic effects, and follow-up surveys of treatment in many neurological & musculoskeletal diseases. Pressure pain thresholds measured by pressure algometry may produce different results depending on many factors as sex, investigator, and apparatus.

Diabetes Mellitus is a major cause of peripheral neuropathy. Sensory symptoms like sensory loss & numbness predominate usually. However some patients also suffer painful or "positive" symptoms, which can be extremely distressing and difficult to treat[3,4] Microangiopathy is the leading cause of diabetic neuropathy associated with metabolic, vascular ischemic and immunologic injury. In many types of peripheral neuropathy large diameter nerve fibres are predominantly affected. However, in diabetic neuropathy small diameter fibres are particularly liable to be involved[5]. Autonomic denervation is common in diabetics with neuropathic foot lesions[6-8] and Guy et al[9] have found that temperature appreciation (subserved by Aδ and C fibres) is more frequently abnormal than vibration perception threshold (large Aβ fibre function) in diabetic neuropathy. Involvement of large nerve fibres was shown by abnormalities in electrophysiological tests.

Reduced appreciation of noxious stimuli was observed in diabetic neuropathy patients; however hyperglycemic patients the pain thresholds were reduced[9]. Hyperglycemic states contribute to a decrease in pain threshold in the alloxan diabetic rats. In contrast, increase in pain threshold was observed in diabetic rats with normalization of blood glucose level[10]. We conclude from this study that measurement of pressure pain thresholds in diabetic neuropathy patients may give qualitative information about disturbances in pain pathways. However, it is of limited value as a quantitative measure of small nerve fibre dysfunction.

Conclusion

1. There is increase in pain thresholds in DPN patients compared to healthy controls.
2. Pain thresholds determined by Digital Algometer is simpler, less time consuming, economical, easier to apply and non-invasive method.
3. Pain threshold is a useful parameter for assessing response to the treatment.
4. Can be used for defining the onset of diabetic neuropathy.
5. But not useful in diagnosis or even as a screening method.
6. Quantification of sensory function can be used to detect disruption of sensory pathways at all levels of the nervous system.

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