INSULIN RESISTANCE AS A PREDICTOR OF SENSORY NEUROPATHY IN PREDIABETES

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Abstract:
Aim- *The aim of this study is to find the correlation between insulin resistance as a sensory neuropathy predictor in prediabetes.*
Methodology- *In this study level of fast serum insulin was measured and insulin homeostatic assessment model was calculated for all the patients.The study was conducted in Bahawlpur Victoria hospital From January 2018_ January 2019. During the determination of vibration perception threshold VPT by using Biothesiometer, comparison was done of sensory neuropathy in prediabetic patients which those who did have sensory neuropathy. Moreover, between VPT and insulin resistance direct relation was analyzed.*
Results- *For this study total 60 patients were selected having prediabetic cases. The age of selected patients was between 35 to 60 years and the mean age was 48.68 years. In selected subject males were 65% whereas the females were 35%. The minimum level of fasting insulin serum was 3.5 mIU/L whereas the maximum level of fasting serum insulin was 21.8 mIU/L and the mean value was 10.61 ± 4.99 mIU/L. The minimum HOMA-IR was 0.986 and the maximum of it was 6.4 whereas the mean value of it was 2.81 ± 1.37. Using digital Biothrsiometer, according to VPT measured around 43.3% patients had neuropathy. In patients with neuropathy as compared to the patients without neuropathy HOMA-IR (P=0.032) and serum insulin level (P=0.026) was significantly higher. There was significant positive relation found of VPT with HOMA-IR IR (Pearson correlation coefficient = 0.299 [R], 0.281 [L]; P = 0.02 [R], 0.03 [L]) and fasting insulin serum level levels (Pearson correlation coefficient = 0.317 [R], 0.296 [L]; P = 0.013 [R], 0.022 [L]).*
Conclusion- *HOMO-IR, quantified with the help of index and insulin resistance are correlated with the development of sensory neuropathy.*
Keywords: *Prediabetes, Neuropathy, Insulin resistance*

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INTRODUCTION:

In diabetes mellitus patients the most prevalent complication is diabetic neuropathy which affect 50% of patients with its both types. In prediabetes stage the risk of diabetes is increased due to various blood glucose variables whose density in blood become higher than the normal value but this value still remains lower than the cut off value during diabetes. In prediabetes long term complication of diabetes may also increased including macrovascular and microvascular. In 2014 a study was conducted in Pakistan in which 32.8% patients were found to impaired with prediabetes. In another study, for normal new-onset diabetes, prediabetes, glycemia the prevalence of peripheral neuropathy was 50%, 49% and 29%. In poor microvascular outcomes of diabetes and fasting insulin resistance a strong relation exists. Prediabetes is a stage in which level of insulin resistance I creases but it remains lower than the level which produce diabetes. In prediabetes in the development of peripheral neuropathy insulin resistance play an important role. However, on this a very few data are available. The aim of this study is to find the correlation between insulin resistance as a sensory neuropathy predictor in prediabetes.

METHODOLOGY:

Place of Study:
This study was conducted in Quaid-e-Azam Medical College Bahawalpur .

Design of study:
This is a cross sectional study.

Sample Size:
For this study total 60 patients were selected having prediabetic cases. The age of selected patients was between 35 to 60 years and the mean age was 48.68 years.

Inclusion Criteria:
Following is the inclusion criteria for this study
- Target population had prediabetes
- 30 to 60 years old
- Glycated hemoglobin = 5.7%–6.4%
- Fasting plasma glucose between 100 and 125 mg/dL

Exclusion Criteria:
Following is the exclusion criteria
- Vitamin B12 deficiency.
- Chronic glucocorticoid therapy
- Human immunodeficiency virus positive patients
- Neurological disorders
- Malignancy
- Vasculitis
- Leprosy
- Systemic lupus erythematosus
- Patients on chemotherapy
- Smokers
- Patients on anti-tubercular treatment
- Chronic alcoholics
- Hypothyroidism
- Cerebrovascular accidents

In this study level of fast serum insulin was measured and insulin homeostatic assessment model was calculated for all the patients. During the determination of vibration perception threshold VPT by using Biothesiometer, comparison was done of sensory neuropathy in prediabetic patients which those who did have sensory neuropathy. Moreover, between VPT and insulin resistance direct relation was analyzed.

Table 1: Baseline characteristics of study population (*n*=60)

	Minimum	Maximum	Mean ±SD
Age (years)	35	60	48.7 ± 7.8
Fasting serum insulin (mIU/L)	3.5	21.8	10.6 ± 5.0
HOMA IR	0.99	6.4	2.8 ± 1.4

Table 2: Comparison of biochemical parameters in patients with or without neuropathy

	Neuropathy	*n*	Mean±SD	*P*
Serum insulin	No	34	9.36±4.97	0.026
(mIU/L)	Yes	26	12.25±4.62	
HOMA IR	No	34	2.48±1.38	0.032
	Yes	26	3.24±1.25	

SD: Standard deviation, HOMA IR: Homeostatic model assessment of insulin resistance

Table 3: Correlation of vibration perception thresholds (right side) with serum insulin levels and HOMA-IR (*n*=60)

Correlation Indices	Corresponding values
Serum insulin (mIU/L)	
Pearson correlation	0.317
Significant (two-tailed) *P*- value	0.013
HOMA IR	
Pearson correlation	0.299
Significant (two-tailed)	0.02

Table 4: Correlation of vibration perception thresholds (left side) with serum insulin levels and HOMA-IR (*n*=60)

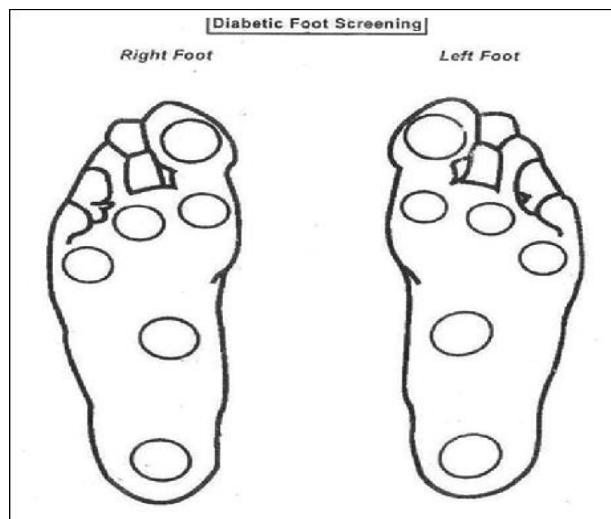| Correlation Indices	Corresponding values
Serum insulin (mIU/L)	
Pearson correlation	0.296
Significant (two-tailed)	0.022
HOMA IR	
Pearson correlation	0.281
Significant (two-tailed)	0.03

Figure 1: Areas to measure vibration perception thresholds in PLANTAR method

DATA ANALYSIS:
The obtained data as entered in MS Excel and SPSS 22.0 as used for statistical analysis. Data representation was done as mean ± standard deviation.

RESULTS:
For this study total 60 patients were selected having prediabetic cases. The age of selected patients was between 35 to 60 years and the mean age was 48.68 years. In selected subject males were 65% whereas the females were 35%. The minimum level of fasting insulin serum was 3.5 mIU/L whereas the maximum level of fasting serum insulin was 21.8 mIU/L and the mean value was 10.61 ± 4.99 mIU/L. The minimum HOMA-IR was 0.986 and the maximum of it was 6.4 whereas the mean value of it was 2.81 ± 1.37. Using digital Biothrsiometer, according to VPT measured around 43.3% patients had neuropathy. In patients with neuropathy as compared to the patients without neuropathy HOMA-IR (P=0.032) and serum insulin level (P=0.026) was significantly higher. There was significant positive relation found of VPT with HOMA-IR IR (Pearson correlation coefficient = 0.299 [R], 0.281 [L]; P = 0.02 [R], 0.03 [L]) and fasting insulin serum level levels (Pearson correlation coefficient = 0.317 [R], 0.296 [L]; P = 0.013 [R], 0.022 [L]).

DISCUSSION:
In diabetes mellitus patients the most prevalent complication is diabetic neuropathy which affect 50% of patients with its both types. In prediabetes stage the risk of diabetes is increased due to various blood glucose variables whose density in blood become higher than the normal value, but this value still remains lower than the cut off value during diabetes. In prediabetes long term complication of diabetes may also increase including macrovascular and microvascular. In 2014 a study was conducted in Pakistan in which 32.8% patients were found to impaired with prediabetes. In another study, for normal new-onset diabetes, prediabetes, glycemia the prevalence of peripheral neuropathy was 50%, 49% and 29%. In poor microvascular outcomes of diabetes and fasting insulin resistance a strong relation exists. Prediabetes is a stage in which level of insulin resistance I creases but it remains lower than the level which produce diabetes. In prediabetes in the development of peripheral neuropathy insulin resistance play an important role.

Patients were evaluated for the event of neuropathy by estimating VPTs utilizing Biothesiometer. Measurable connections of neuropathy in prediabetic patients with fasting serum insulin levels and HOMA-IR were contemplated.

VPT results have been found to have great connection with nerve conduction speed study (NCV) discoveries. Klima et al. revealed correlation of VPT values, considering whether evoked tangible and engine reactions were acquired in NCV, showed that mean VPTs were reliably higher among patients in whom

these evoked reactions were not elicited. VPT was a delicate indicator of distal symmetric polyneuropathy (DSPN), with the most noteworthy affectability noted for affirmed clinical neuropathy (87%). The affectability of VPT to anticipate positive clinical neuropathy and strange nerve conduction was 80% and 75%, respectively. Hence, VPTs can dependably distinguish tangible neuropathy and fill in as a helpful, less time-consuming, and less difficult choice to nerve conduction contemplates.

Insulin opposition is firmly connected with microvascular inconveniences of diabetes and is a significant objective of intercession as expanded insulin affectability prompts improved microvascular results. It is estimated that higher insulin levels quicken hyperglycemia-mediated microvascular harm because of expanded oxidative stress.[10] Recently, a few examinations indicated that the segments of metabolic condition obviously affected the pathogenesis of fringe neuropathy. Insulin obstruction is the center element of metabolic disorder. Information have collected to recommend that neurons could likewise create insulin obstruction, bringing about neuronal injury. The segments of metabolic disorder and insulin opposition both may assume a significant job in the improvement of fringe neuropathy.

CONCLUSION:
HOMO-IR, quantified with the help of index and insulin resistance are correlated with the development of sensory neuropathy.

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