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Physiology

ELECTROPHYSIOLOGICAL STUDY OF NERVE CONDUCTION LATENCY IN LOWER LIMBS IN SMOKERS

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ABSTRACT

INTRODUCTION: Smoking is the most common method of consuming tobacco which can lead to impairments in impulse conduction of sensory and motor nerves. Nerve conduction latency is an important parameter of sensory and motor nerve conduction studies. The present study was undertaken to assess nerve conduction latency in lower limbs in male smokers

OBJECTIVES: To study nerve conduction latency in lower limbs in sensory (Sural) and motor (Peroneal) nerves in healthy male smokers and comparing it with age, BMI matched non-smokers.

MATERIAL AND METHODS: Study was carried out in 120 subjects belonging to age group 25-45 years. Sensory and motor nerve conduction latency was tested in Sural and Peroneal nerves respectively by standard method in apparently healthy male smokers, who were subdivided into mild, moderate and heavy smokers group (30 subjects/group) according to smoking index. Control group had 30 age & BMI matched non-smokers. Mean value of nerve conduction latency of different groups was compared statistically by one way Anova test and Bonferroni's test.

RESULTS: The difference in mean values of nerve conduction latency (m/sec) in Sural (sensory) nerve of smokers was statistically significant among all the compared groups. The difference in mean values of nerve conduction latency (m/sec) in Peroneal (motor) nerve was statistically non-significant among all the compared groups.

A significant correlation was observed between smoking index and Sural (sensory) nerve conduction latency. A non-significant correlation was observed between smoking index and peroneal nerve conduction latency.

CONCLUSION: Smoking increases nerve conduction latency in sensory (Sural) nerve while it does not significantly affect nerve conduction latency in motor (Peroneal) nerve in lower limbs in apparently healthy smokers.

KEYWORDS : Nerve conduction latency, Smokers, Sural nerve, Peroneal nerve.

BACKGROUND:

Smoking is the most common method of consuming tobacco, and tobacco is the most common substance used to smoke. The resulting smoke is then inhaled and the active substances are absorbed through the alveoli in the lungs or the oral mucosa.[1] Most smokers develop impairments in impulse conduction of sensory and motor nerves.[2] Nerve conduction Latency is an important parameter of sensory and motor nerve conduction studies. Latency is the time required for impulse to travel along the nerve up to muscle. The present study was undertaken to assess nerve conduction latency in lower limbs in male smokers

MATERIAL AND METHODS:

The study was a comparative cross-sectional type. The study was approved by the local ethics committee. The subjects were thoroughly interviewed using a standard questionnaire. Details of subject were recorded on record sheet. Detailed history was taken about past illnesses and treatment. Written informed consent was taken from all the subjects. Preliminary clinical examination was done.

Participants in the study with age below 25 years and more than 45 years; having past history of diabetes; showing symptoms and signs of peripheral neuropathy; having history of renal problems; having history/signs of Chronic Obstructive Pulmonary Disease; having hypertension; showing signs of anaemia; having history of consumption of neurotoxic drugs; having history/signs of peripheral vascular diseases and Carpal tunnel syndrome; having history of hepatitis; having history of consumption of alcohol, Gutaka or chewing tobacco; were excluded from the study.

Participants having normal BMI (19-24.9 kg/m^2) and subjects who gave a wilful consent for the study, were selected for the study.

Total 120 subjects were selected for the present study. History of smoking (numbers of cigarettes/day) and duration was asked. Smoking index was calculated by the formula: Smoking index = (frequency x duration in years).[3]

Based on Smoking index, subjects were then classified into following subgroups

Table 1 – Division Of Various Groups With Reference To Smoking Index

Group	Description	Sample size	Smoking Index
Group I	Nonsmokers	30	0
Group II	Light/Mild	30	1 to 100
Group III	Moderate	30	101 to 200
Group IV	Heavy	30	>200

Subjects were informed in detail about the nerve conduction study procedure and written informed consent was taken. They were all subjected to nerve conduction test in an air-conditioned room maintained at temperature of 21^0-23^0 C.[2] RMS Salus 2C Electromyograph recorded on HP monitor equipment was used for finding nerve conduction latency.

Before carrying out the study, the subjects were familiarized with the procedure. Nerve conduction examination test was done in lying down position on Sural and Peroneal nerves. Electrode placement was done for the test according to the standard technique.[4]

Readings were taken for nerve conduction latency (m/s). Mean values of nerve conduction latency were compared between all the groups by one way Anova test. Mean values of nerve conduction latency were also compared among different subgroups by bonferroni's test. p value <0.05 was taken as statistically significant (for both the tests).

RESULTS:

Table 2: Table Showing Comparison Of Study And Control Group With Respect To Sural Nerve Conduction Latency

Groups	Conduction Latency in Sural nerve (m/sec) [mean ± SD]	"p" Value (One way ANOVA Test)
I	**3.18 ± 0.73**	**p< 0.05**
II	**3.27 ± 1.01**	
III	**3.95 ± 1.0**	
IV	**4.06 ± 0.75**	

Table 3: Bonferroni's Multiple Comparison Test For Sural Nerve Conduction Latency (Post HOC Test)

Group comparison	t value	"p" value	Significance
GR I vs GR II	**0.4057**	**> 0.05**	**Non significant**
GR I vs GR III	**3.384**	**< 0.05**	**Significant**
GR I vs GR IV	**3.838**	**< 0.05**	**Significant**
GR II vs GR III	**2.978**	**< 0.05**	**Significant**
GR II vs GR IV	**3.432**	**< 0.05**	**Significant**
GR III vs GR IV	**0.4541**	**> 0.05**	**Non significant**

Graph 1: Correlation Graph Between Smoking Index And Sural Nerve Conduction Latency

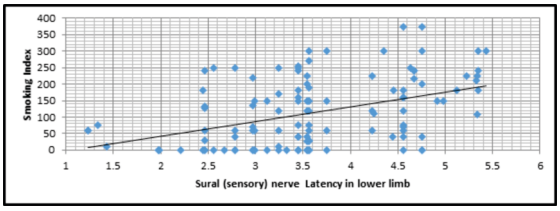


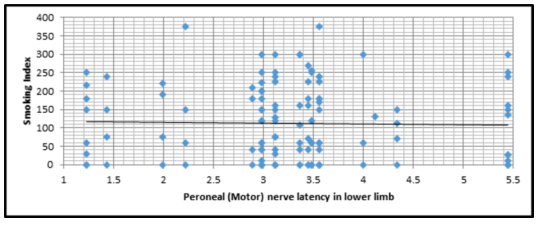
Table 4: Table Showing Comparison Of Study And Control Group With Respect To Peroneal Nerve Conduction Latency

Groups	Conduction Latency in Peroneal nerve (m/sec) [mean + SD]	"p" Value (One way ANOVA Test)
I	**3.23 ± 0.97**	**p > 0.05**
II	**3.23 ± 0.97**	
III	**3.37 ± 1.05**	
IV	**3.41 ± 1.02**	

Table 5 - Bonferroni's Multiple Comparison Test For Peroneal Nerve Conduction Latency (Post HOC Test).

Group comparison	"t" value	"p" value	Significant
GR I vs GR II	**0.1403**	**>0.05**	**Non Significant**
GR I vs GR III	**0.1554**	**>0.05**	**Non Significant**
GR I vs GR IV	**0.6887**	**>0.05**	**Non Significant**
GR II vs GR III	**0.0151**	**>0.05**	**Non Significant**
GR II vs GR IV	**0.5485**	**>0.05**	**Non Significant**
GR III vs GR IV	**0.5333**	**>0.05**	**Non Significant**

Graph 2: Correlation Graph Between Smoking Index And Peroneal (motor) Nerve Conduction Latency



DISCUSSION:

There was a significant difference in mean values of Sural (sensory) nerve conduction latency amongst all the groups. (Table 2)

There was no statistical difference in Sural nerve conduction latency between non-smoker and mild smoker group and between moderate and severe smoker group. However there was significant difference in Sural nerve conduction latency between non-smoker and moderate smoker group, between non-smoker and heavy smoker group, between mild smoker and moderate smoker group and between mild smoker and severe smoker group (p value <0.05).(Table 3)

A significant positive correlation was observed between smoking index and Sural (sensory) nerve conduction latency of lower limb. (Graph 1)

There was no significant difference in mean values of Peroneal (motor) nerve conduction latency amongst all the groups. (Table 4)

There was no statistically significant difference in Peroneal (motor) nerve conduction latency when all the groups were compared individually to one another. (Table 5)

Non-significant correlation was observed between smoking index and peroneal nerve conduction latency in lower limb. (Graph 2)

Thus Sural (sensory) nerve conduction latency is prolonged but Peroneal (motor) nerve conduction latency doesn't show significant change as smoking index increases.

It has been observed that nerves of lower limb are more commonly affected suggesting that long nerves such as sural nerve are more commonly affected.[5]

Also the blood supply to the sural nerve is different in that there are no arterial pedicles to it.[6] As reduction of blood supply to nerve is important in pathogenesis of nerve function, hence sural nerve is more commonly affected.

Paramelle B et al[7] observed some degree of demyelination in peripheral sensory nerves in 43 severe smokers**.** In the present study, similar findings were found in moderate and severe smokers, who showed prolonged latency which is suggestive of damage to myelin sheath.

Nicotine present in smoke worsens these effects inducing subclinical changes in tunica intima of blood vessels.[8] Nicotine too has a direct effect on the myelin sheath.[9]

observed latency of the sensory nerve.

Faden A. et al[10] and G. Valli et al[11] noted prolonged sensory nerve conduction latency more commonly than motor.

In the present study, no significant change in motor nerve latency in peroneal nerve was observed as the study included healthy smokers.

Sensory nerves are thinner than motor nerves and have shorter internodal distance. Hence sensory nerves are affected earlier than motor nerves.[12]

CONCLUSION:

The findings of present study conclude that smoking prolongs conduction latency in sensory (Sural) nerve while it does not significantly affect conduction latency in motor (Peroneal) nerve in lower limbs in apparently healthy smokers.

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