ORIGINAL RESEARCH PAPER

Volume-8 | Issue-2 | February-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

IS MEDIAN NERVE CONDUCTION LATENCY AFFECTED IN SMOKERS? - A COMPARATIVE STUDY

Physiology

Dr.Sagar R. Chavan Assistant professor, Department of Physiology, BJ Government Medical College, Pune.

Dr Sneha H. Sathe* Associate professor, Department of Physiology, BJ Government Medical College, Pune.
*Corresponding Author

ABSTRACT

Introduction: Smoking tobacco can lead to delay in impulse conduction of nerves. Nerve conduction latency is a vital parameter in nerve conduction study. The present study was undertaken to assess median nerve conduction latency in male smokers

Objectives: To study median nerve conduction latency 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 median nerve by standard method in healthy male smokers, who were subdivided according to smoking index into mild, moderate and heavy smokers group (30 subjects/group). 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 median sensory nerve of smokers was statistically significant among all the compared groups. The difference in mean values of nerve conduction latency (m/sec) in median motor nerve was statistically non-significant among all the compared groups.

A significant positive correlation was observed between smoking index and median sensory nerve conduction latency. A non-significant correlation was observed between smoking index and median motor nerve conduction latency.

Conclusion: Smoking increases nerve conduction latency in median sensory nerve while it does not significantly affect nerve conduction latency in median motor nerve in apparently healthy smokers.

KEYWORDS

Nerve conduction latency, Smokers, median nerve.

BACKGROUND:

Tobacco use is one of the main risk factors for a number of chronic diseases. In spite of this there is still rising in number of smokers in the developing world.[1] More than 1 million die each year due to tobacco in India.[2] About 17% smokers in the world live in India and they are at the higher risk.[3] Most smokers develop deficiency in impulse conduction of nerves.[4] Nerve conduction latency which is an important component of nerve conduction studies, is the duration required for impulse to travel along the nerve up to muscle. The present study was undertaken to assess median nerve conduction latency in apparently healthy male smokers.

MATERIAL AND METHODS:

The study was a comparative cross-sectional type. The study was approved by the ethics committee of institute. The subjects were interviewed using a standard questionnaire and individual information was recorded. History was taken about past illnesses and treatment. Written informed consent was obtained from all the subjects and 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 recorded. Smoking index was calculated by the formula: Smoking index = (frequency x duration in years).[5]

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

Table 1 – Division of various groups with reference to smoking index

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

Subjects were acquainted with the nerve conduction study procedure and written consent was taken. RMS Salus 2C Electromyograph recorded on HP monitor equipment was used for finding median nerve conduction latency.

The median nerve conduction test was performed in an air-conditioned room maintained at temperature of 21^0-23^0 C.[4] Electrodes for the test were placed according to the standard technique.[6] Readings were taken for median nerve conduction latency (m/s). Mean values of median nerve conduction latency were compared between all the groups by one way Anova test. Mean values of nerve conduction latency were also compared individually among different subgroups by Bonferroni's test. p value <0.05 was taken as statistically significant (for both the tests).

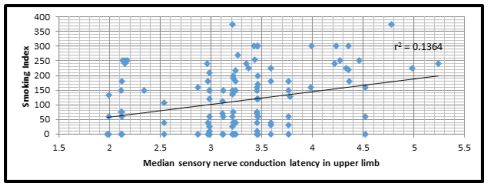
RESULTS:

Table 2: Table showing comparison of study and control group with respect to median sensory nerve conduction latency

Groups	Median sensory nerve conduction latency (m/sec)[mean + SD]	"p" Value (One way ANOVA Test)
I	3.08±0.58	p< 0.05
II	3.17±0.55	
III	3.22±0.54	
IV	3.58±0.86	

Table 3: Bonferroni's multiple comparison test (Post HOC Test) for median sensory nerve conduction latency

Group comparison	t value	"p" value	Significance
GR I vs GR II	0.4340	P > 0.05	Non-significant
GR I vs GR III	0.4340	P > 0.05	Non- significant
GR I vs GR IV	3.019	P < 0.05	Significant
GR II vs GR III	0.0000	P > 0.05	Non-significant
GR II vs GR IV	2.585	P < 0.05	Significant
GR III vs GR IV	2.585	P < 0.05	Significant



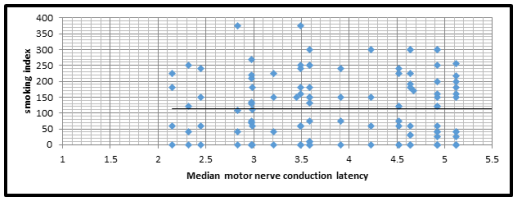
Graph 1: Correlation graph between smoking index and median sensory nerve conduction latency

Table 4: Table showing comparison of study and control group with respect to median motor nerve conduction latency

Groups	Conduction Latency in median motor (m/sec) [mean + SD]	"p" Value (One way ANOVA Test)
I	3.57 ± 0.97	p > 0.05
II	3.92 ± 0.96	
III	3.87 ± 0.99	
IV	4.03 ± 0.92	

Table 5 - Bonferroni's multiple comparison test for median motor nerve conduction latency

Group comparison	"t" value	"p" value	Significant
GR I vs GR II	1.443	>0.05	Non Significant
GR I vs GR III	1.198	>0.05	Non Significant
GR I vs GR IV	1.862	>0.05	Non Significant
GR II vs GR III	0.2450	>0.05	Non Significant
GR II vs GR IV	0.4190	>0.05	Non Significant
GR III vs GR IV	0.6640	>0.05	Non Significant



DISCUSSION:

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

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

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

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

There was no statistically significant difference in median 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 median motor nerve conduction latency. (Graph 2)

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

G. Valli et al and few other researchers in their respective studies noted prolonged sensory nerve conduction latency more commonly than motor. [7,8]

In the present study, median sensory nerve showed prolonged latency which is suggestive of damage to myelin sheath.[9]

Nicotine in tobacco has a direct effect on the myelin sheath[10] and it also causes subclinical changes in tunica intima of blood vessels.[11]

Higher carboxyhemoglobin levels in the circulating blood found in smokers leads to slowing of nerve conduction by its direct action over the myelin sheath.[7]

Sensory nerves have lesser internodal distance. Also anatomical separation of median nerve into sensory and motor branches, takes place early in its course and after bifurcation, median sensory nerve becomes much thinner than median motor, hence gets affected more than motor nerve.[12]

Smoking also causes vasoconstriction and damages blood vessels by atherosclerosis, plaque formation etc resulting in neural ischemia.[13]

Sensory fibres of median are not affected significantly in mild smoker, and any pathogenesis which may have occurred can be easily reversed. Hence early detection of peripheral nerve damage by nerve conduction studies should be carried out in smokers and followed by proper counselling which will help in prevention and progression of peripheral nerve damage.

CONCLUSION:

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

Table 4 : Table showing comparison of study and controlled group with respect to Sensory nerve latency in upper limb

Smoking index	Groups				"P" Value (One way ANOVA Test)
	I (n=30)	II (n=30)	III (n=30)	IV (n=30)	
Latency (ms) (mean + SD)	(3.08+0.58)	(3.17+55)	(3.22+ 0.54)	(3.58+ 0.86)	0.0120 (significant)

'p' < 0.05 shows that the difference of latency in study and control group is significant

Multiple comparison: Bonferroni Test(Post HOC Test)

Sensory nerve amplitude in upper limb Groups compared	t value	P value	Significant
GR I vs GR II	0.4340	P > 0.05	Non-significant
GR I vs GR III	0.4340	P > 0.05	Non- significant
GR I vs GR IV	3.019	P < 0.05	Significant
GR II vs GR III	0.0000	P > 0.05	Non-significant
GR II vs GR IV	2.585	P > 0.05	Significant
GR III vs GR IV	2.585	P > 0.05	Significant

moderate smoker group (p value >0.05). However there is highly significant difference between non-smoker and sever smoker groups (p value <0.05) nerve latency.

Fig .4 Correlation graph

Table 10: Table showing comparison of study and controlled group with respect to Motor nerve latency in upper limb

Smoking index	Groups				"P" Value (One way ANOVA Test)
Upper limb Motor nerve latency (ms) (mean + SD)	I (n=30)	II (n=30)	III (n=30)	IV (n=30)	(>0.0001) Not significant
	(3.57+ 0.97)	(3.92+ 0.96)	(3.87+ 0.99)	(4.03+ 0.92)	

'p' > 0.05 shows that the difference of Motor nerve conduction latency in upper limb in study and control group is non-significant

Multiple comparison: Bonferroni Test (Post HOC Test)

There is no significant statistical difference between non-smoker and mild , moderate or severe smoker group (p value > 0.05).

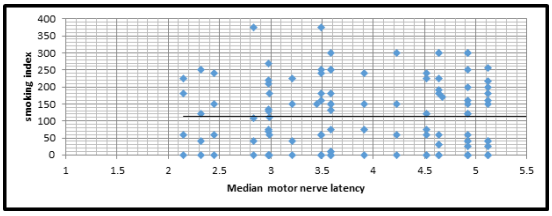
Motor nerve latency in upper limb Groups compared	t value	P value	Significant
GR I vs GR II	1.443	> 0.05	Non Significant

GR I vs GR III	1.198	> 0.05	Non Significant
GR I vs GR IV	1.862	> 0.05	Non Significant
GR II vs GR III	0.2450	> 0.05	Non Significant
GR II vs GR IV	0.4190	> 0.05	Non Significant
GR III vs GR IV	0.6640	> 0.05	Non Significant

Multiple comparison: Bonferroni Test (Post HOC Test)

There is no significant statistical difference between non-smoker and mild , moderate or severe smoker group (p value > 0.05).

Correlation graph



No significant correlation is observed between smoking index and motor nerve latency in upper limb

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