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EFFECT OF SMOKING ON NERVE CONDUCTION VELOCITY OF MEDIAN NERVE

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ABSTRACT

Introduction: There are very few ambiguous and inconclusive studies, who have worked on nerve conduction functions in smokers. Hence, present study was undertaken.

Objectives: To study Nerve Conduction Velocity (NCV) in sensory and motor fibres of median nerve in healthy male smokers and compare with age, BMI matched non-smokers.

Material and Methods: Study was conducted in 120 subjects belonging to age group 25-45 years. Sensory and motor NCV was tested in median nerve in dominant upper limb by standard method in apparently 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 values of NCV of different groups were compared statistically by one way Anova test and Bonferroni's test.

Results: The difference in mean values of NCV (m/sec) in sensory median nerve of smokers was statistically significant among all the compared groups. The difference in mean values of NCV (m/sec) in motor median nerve was statistically non-significant among all the compared groups.

Conclusion: Smoking reduces conduction velocity in sensory fibres of median nerve while it does not affect conduction velocity in motor fibres in apparently healthy smokers.

Background:

Tobacco smoking is the practice of burning tobacco and inhaling the smoke (particle and gaseous forms) resulting in the active substances being absorbed through the alveoli in the lungs or the oral mucosa.[1] Smoking is the most common method of consuming tobacco, and tobacco is the most common substance used to smoke. Tobacco smoking is the second major cause of death in the world. There were 100 million premature deaths due to tobacco in the 20th century, and this number is expected to rise to 1 billion in the 21st century.[2] There are approximately 120 million smokers in India. According to the World Health Organization (WHO), India is the home of the world's smokers. About 17% smokers in the world live in India.[3]

Smoking cigarettes is one of the main independent factor leading to peripheral neuropathy. A nerve conduction study (NCS) is a medical diagnostic test commonly used to evaluate the ability of electrical conduction, of the motor and sensory nerves of the human body. Nerve conduction studies are there for better diagnosis of various neuropathies, especially demyelinating conditions which affect nerve conduction parameters.[4] Nerve conduction studies establish early diagnosis about peripheral nerve damage due to smoking, even before the subject develops signs and symptoms of peripheral neuropathy.

Very few Indian studies are available which can give the information about effect of smoking on peripheral nerves. The result of these studies is highly ambiguous and inconclusive. Hence, the present study was undertaken to assess nerve conduction functions in male smokers and correlate the severity of peripheral nerve damage with cigarette usage.

Material and methods:

The present study was a cross-sectional study. The study was approved by the local institutional ethics committee. The subjects were thoroughly interviewed using a standard questionnaire. Details of subject including name, age, gender, address, and contact number were recorded on a record sheet. Detailed history was asked about past illnesses and treatment. According to the study protocol, preliminary clinical examination was done. Written informed consent was taken before doing the clinical examination of the subjects.

Subjects with age less than 25 and more than 45 years; subjects having symptoms and signs of peripheral neuropathy on history and clinical examination; subjects having history/signs of Chronic Obstructive Pulmonary Disease; subjects having past history of diabetes and raised random BSL at the time of examination; subjects showing signs of anaemia; hypertensive subjects; subjects with history of consumption of alcohol, Gutaka or chewing tobacco; subjects with history of consumption of neurotoxic drugs; subjects with history of hepatitis; subjects with history of renal problems; subjects with history/signs of peripheral vascular diseases and Carpal tunnel syndrome were excluded from the present study.

Subjects having normal BMI (19-24.9 kg/m^2); subjects having random blood sugar level below 120 mg/dl (as done on portable Accu-Chek glucometer); subjects with right side as dominant limb and subjects who gave a wilful consent for the study, were selected for the current study.

Finally 120 subjects were selected for the present study. 30 apparently healthy male non - smokers in age group of 25 to 45 years served as the control group. 90 apparently healthy male smokers served as the study group. 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) [5]

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

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

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

Subjects were then explained in detail about the nerve conduction study procedure. They were all assessed in an air-conditioned room maintained at temperature of 21^0-23^0 C.[4] RMS Salus 2C Electromyograph recorded on HP monitor equipment was used for finding NCV. Before performing the study, the subjects were familiarized with the apparatus and the procedure. Nerve conduction examination test was done on right median nerve in

lying down position. Electrode placement was done for median motor and sensory nerve conduction velocity test, according to the standard technique.[4] Readings were taken for nerve conduction velocity (NCV) (m/s). Mean values of NCV were compared between control group (non-smokers) and study group (smokers) by one way Anova test. Mean values of NCV 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 sensory nerve conduction velocity in median nerve

Groups	Conduction Velocity in sensory median nerve (m/sec) [mean + SD]	"p" Value (One way ANOVA Test)
I	54.92±1.5	p < 0.0001
II	54.47±1.5	
III	53.53±1.79	
IV	51.79±2.01	

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

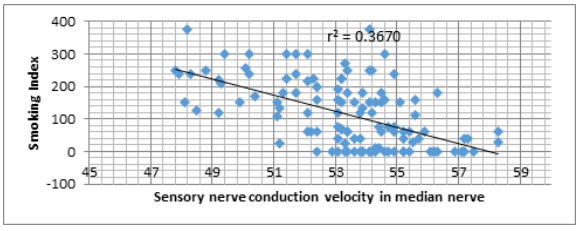

Table 3 - Bonferroni's multiple comparison test for sensory nerve conduction velocity in median nerve (Post HOC Test)

Group comparison	"t" value	"p" value	Significant
GR I vs GR II	0.9380	P > 0.05	Non-significant
GR I vs GR III	4.111	P < 0.05	Significant
GR I vs GR IV	7.380	P < 0.05	Significant
GR II vs GR III	3.173	P < 0.05	Significant
GR II vs GR IV	6.442	P < 0.05	Significant
GR III vs GR IV	3.269	P < 0.05	Significant

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

Groups	Conduction Velocity in motor median nerve (m/sec) [mean + SD]	"p" Value (One way ANOVA Test)
I	54.96±2.61	p > 0.05
II	54.63±2.41	
III	54.40±1.89	
IV	54.06±3.01	

Graph 2: Correlation graph between smoking index and motor nerve conduction velocity in median nerve

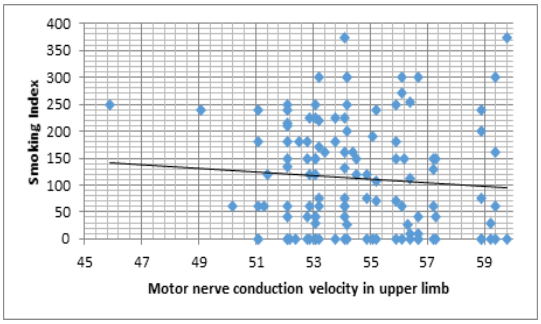

Table 5: Bonferroni's multiple comparison test for motor nerve conduction velocity in median nerve (Post HOC Test)

Group comparison	t value	"p" value	Significance
GR I vs GR II	0.5128	>0.05	Non Significant
GR I vs GR III	0.8666	>0.05	Non Significant
GR I vs GR IV	1.390	>0.05	Non Significant
GR II vs GR III	0.3538	>0.05	Non Significant
GR II vs GR IV	0.8768	>0.05	Non Significant
GR III vs GR IV	0.5230	>0.05	Non Significant

Discussion :

There was a significant reduction in median sensory nerve conduction velocity in moderate and heavy smokers as compared to non-smokers. (Table 2)

There was a significant difference in median sensory nerve conduction velocity, between mild and moderate smoker groups, and, moderate and severe smoker groups. (Table 3)

Thus sensory nerve conduction velocity in median nerve is reduced as smoking index increases.

There was no significant reduction in median motor nerve conduction velocity in smokers as compared to non-smokers. (Table 4)

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

A strong negative correlation was observed between smoking index and sensory nerve conduction velocity in median nerve while no significant correlation was observed between smoking index and motor nerve conduction velocity in median nerve. (Graph1, Graph 2)

Different studies done by various researchers like Tayade[6] et al in 2012, Suman Sharma[7] et al in 2016 and Shrivastava[8] et al. in 2017 also found significant changes in sensory NCV of median nerve but no significant changes seen in motor NCV in smokers which is comparable to our studies.

Oxidative stress caused by smoking results in lipid peroxidation and destruction of lipid component of biological membrane of peripheral nerves[9] and induces alteration in membrane permeability properties of tissue resulting in changes in signal transduction and electrolyte imbalance.[10,11] Decrease in total antioxidant capacity in smokers leads to further increase in oxidative stress leading to decrease in nerve conduction velocity of sensory nerves.[12] Smoking causes vasoconstriction and damages blood vessels by atherosclerosis and plaque formation resulting in neural ischemia.[13] Carbon monoxide released during smoking also damages tunica intima of blood vessels and endothelial cells, which further leads to deposition of fats in the vessel walls.[14] Nicotine present in smoke induces subclinical changes in tunica intima of blood vessels[14] and also has a direct effect on the myelin sheath.[15]

Conclusion:

The findings of present study conclude that smoking reduces conduction velocity in sensory fibres of median nerve while it does not affect conduction velocity in motor fibres in apparently healthy smokers.

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