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Research Article

Influence of tobacco on median and ulnar nerve in the population of South Rajasthan

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ABSTRACT

Background: Chemicals present in tobacco have been implicated in causing subclinical changes in myelin sheaths of peripheral nerves. This may contribute to nerve dysfunction particularly in the form of decreases in nerve conduction velocity. So, present study aims to measure nerve conduction velocity in the median nerve and ulnar nerve among tobacco users.
Methods: This was a cross-sectional case-control study involving 50 normal healthy subjects and 150 tobacco users. The nerve conduction study was performed using fully computerized electromyography (EMG) and nerve conduction velocity (NCV) machine. By this machine Sensory nerve conduction velocity (SNCV) and Motor nerve conduction velocity (MNCV) tests of both the nerves (median and ulnar) was performed on subjects. Data was analyzed by using appropriate statistical methods.
Results: In our study statistically significant changes ($P < 0.001$) were found in the Sensory nerve conduction velocity of both the nerves whereas no such changes were found in Motor nerve conduction velocity of both the nerves in tobacco users as compared to nontobacco users.
Conclusions: We conclude that use of tobacco results in reduction of conduction velocities in sensory fibers of the median nerve and ulnar nerve but not in motor fibers.

Keywords: Nerve conduction study, NCV, MNCV, SNCV, Tobacco

INTRODUCTION

Nerve conduction study is an important diagnostic tool for evaluating functional integrity of the peripheral nerve and neuromuscular junction. Nerve conduction study helps in differentiating two major groups of peripheral nerve disease demyelination and axonal degeneration. It helps to delineate the extent and distribution of neural lesion.[1] Conduction velocity of nerve depends on the fiber diameter, degree of demyelination and internodal distance. The nerve conduction is affected by many variants like age, sex, race, height, skin temperature, body built, tobacco consumption and alcohol consumption.[2-4]

In present scenario, tobacco continues to be the leading causes of preventable death, resulting in an expected increase of death rate from 1.5 to 7 million annually by 2020 around the globe.[5] Cigarette smoke possess a significant human health hazard, especially affecting vascular hemodynamic and multisystem involvement. Chemicals in cigarette smoke like nicotine, tar, carbon monoxide etc. have been implicated in causing subclinical changes in myelin sheaths of peripheral nerves and resulting demyelination causes poor electrotonic conduction.[6] This may contribute to nerve dysfunction particularly in the form of decreases in nerve conduction velocity. It has been suggested by Richardson that ulnar mononeuropathy at elbow could be associated by excessive use of tobacco. Also the prolonged exposure

to tobacco leads to chronic hypoxemia is having negative effect on nerves, which results in peripheral neuropathy.[7] In recent years, study of nerve conduction is an early diagnostic tool for peripheral neuropathy and has been greatly facilitated by the development of various computer based methods. With this background in our mind it was planned to see the effect of tobacco consumption on median and ulnar nerve in South Rajasthan.

METHODS

A cross sectional case control study was conducted in the Department of Physiology, Geetanjali medical college and hospital, Udaipur. The subjects were chosen randomly, working as contract labourers doing cleaning and maintenance in the institutional campus not occupationally exposed to metals and pesticides. The control subjects were the individual who had never smoked in life and not having any other addiction related to tobacco. The objectives of this study were explained to the subjects and written informed consent was obtained from each subject. After obtaining the ethical clearance from institutional ethics committee, the data from both the groups was collected in the detailed proforma along with requisite physical examination. The subjects were broadly divided into two groups (A & B):

Group A -comprised of Tobacco users (n=150).
Group B had controls (non-tobacco users) (n=50).

Inclusion criteria

Individuals aged between 18-50 yrs with history of smoking cigarette/biddies and chewing tobacco daily, for at least one year were considered as subject. Information on age, socio-economic status, lifestyle patterns such as consumption of alcohol, taking medicines. Including past and present illness, types of tobacco products, duration of smoking, patterns of tobacco use were asked before the starting of examination.

Exclusion criteria

1. Subject suffering from any other systemic or endocrine disorder.
2. Obesity.
3. Severe anaemia (Hb < 6 gm %)
4. Taking alcohols.
5. Ex or past smokers.
6. Subjects with injuries to Arm.
7. Any patients with known peripheral neuropathy with any cause, any radiculopathy, fracture, nerve compression, any form of neurological disorders.

Electrophysiological study

The nerve conduction study was performed using fully computerized EMG and NCV machine (Model Neuroperfect, EMG 2000, Medicaid, Chandigarh). This machine is commercially available equipment, which have simple and user friendly program. By this machine SNCV, and MNCV tests of both the nerves (median and ulnar) was performed on subjects by using surface electrodes which requires less precision in placement and are therefore quicker to use. Also using low noise amplifier and signal averaging minute potentials can be recorded from nerve trunks by using these electrodes. By using computerized technique majority of errors can be eliminated giving more reliable and reproducible results.

Recording of conduction of median nerve

MNCV was recorded by applying the surface recording electrodes on Abductor policis brevis (APB) and ground at the dorsum of hand. The nerve was stimulated supra maximally along its course at two points, distally at wrist between the tendon of Palmaris longus (PL) and Flexor carpi radialis (FCR) and proximally just medial to the tendon of biceps. The distance between the proximal and distal stimulation is measured and MNCV was calculated. The onset latency, amplitude of wave was also calculated.

SNCV was recorded antidromically by placing the recording ring electrodes on the index finger. The cathode was placed at the first interphalengeal joint and anode 3 cm distal to it. Ground electrode at the dorsum of the hand, the stimulating electrode is at the wrist. The stimulation should be sub maximal at wrist. The distance between stimulating and recording electrode is measured and NCV measured. The wave was analysed for onset latency and amplitude.

Recording of conduction of ulnar nerve

MNCV was recorded by applying the surface electrodes on Abductor digiti minimi (ADM) and ground at the dorsum of hand. The nerve was stimulated along its course at three points, at wrist, 4 cm below elbow and 10 cm above elbow. The position of forearm while recording the MNCV from ulnar nerve is very important as it tends to change with different angles of elbow flexion (Sattari). The distances between the proximal and distal stimulation was measured and MNCV was calculated. The onset latency, amplitude of the wave was also calculated.

SNCV was recorded antidromically by pacing the recording ring electrodes on the little finger, ground electrode at the dorsum of the hand, the stimulating electrodes at the wrist. The distance between stimulating and recording electrode is measured and NCV measured. The wave was analysed for onset latency and amplitude.

Motor nerve conduction study setting

Sensitivity: 3 mv / div.
Low frequency filter: 2 Hz.
High frequency filter: 3 Hz.
Sweep speed: 2ms/div.

Notch filter: off.
Supramaximal stimulation: 30-45 mv.

Sensory nerve conduction study setting

Sensitivity: 10 µv / div.
Low frequency filter: 20 Hz.
High frequency filter: 3 Hz.
Sweep speed: 2ms/div.
Notch filter: on.
Submaximal stimulation: 10-15 mv.

The data was analysed by using Statistical Package for the Social Sciences (SPSS) for Windows Version 16.0 (SPSS). Comparison of mean of continuous data between tobacco users and non-tobacco users control group was tested by Student t-test. P-value of <0.05 (two-tailed) was used to establish statistical significance.

RESULTS

Table 1: Nerve conduction velocities in group A and group B in median nerve and ulnar nerve.

Variables (m/sec.)	Group-A Tobacco users Mean ± SD	Group-B nontobacco users Mean ± SD	T value	P Value
MNCV (Median)	66.23 ± 15.60	66.94 ± 14.59	0.14	0.889
MNCV (Ulnar)	55.40 ± 14.46	60.64 ± 12.55	1.31	0.194
SNCV (Median)	34.02 ± 13.67	49.60 ± 10.42	4.10	0.000
SNCV (Ulnar)	28.90 ± 9.97	44.96 ± 9.24	3.79	0.001

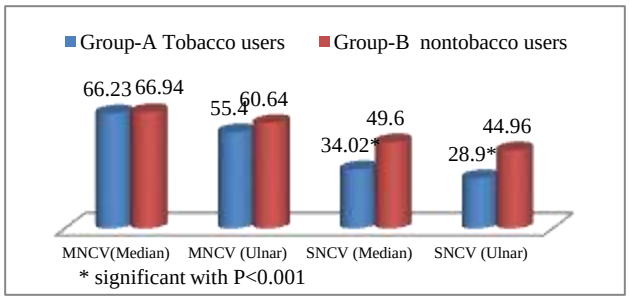

Figure 1: Nerve conduction velocities in group A and group B in median nerve and ulnar nerve.

DISCUSSION

Cigarette smoke is a complex mixture of chemicals containing more than 4000 different constituents. Some of the compounds identified include pyridine alkaloids such as nicotine, ammonia, acrolein, phenols, acetaldehyde-N-nitrosamine, polycyclic aromatic hydrocarbons such as benzopyrine, combustion gases such as carbon monoxide, nitrogen oxides, hydrogen cyanide, and trace metals, emitter radioactive elements such as polonium, radium and thorium.[8]

Chemicals present in tobacco are toxic to the peripheral nerves and also for the myelin sheath. Demyelination resulting poor electrotonic conduction and subclinical changes in myelin sheaths of peripheral nerves were found due to chemicals present in cigarette smoke. This may contribute to nerve dysfunction particularly in the form of decreases in nerve conduction velocity as in our study sensory nerve conduction velocity was significantly reduced shown in Table 1 and Figure 1. In our present study, we found no statistically significant changes in motor nerve conduction velocity while reduction in sensory nerve conduction velocity was seen in tobacco users which are in concurrence with similar studies.[14] This may be due to the fact that sensory nerves are thinner than the motor nerves and are having shorter intermodal distances. As a rule the thinner nerves are early affected than the thicker nerves by any damage. Hence the sensory fibers may be more affected than the motor nerve fibers of a mixed nerve.[13]

The body's overall vascular and neural functions are closely related. The initial change which occurs as a result of smoking is constriction of microvasculature. Such microvascular function impairment occurs early in smoking. Smoking affects peripheral ends of nerves and then slowly proceeds towards the centre. Myelin, forming a layer around the axon, is essential for the normal functioning of the nervous system. Smoking initially induces subclinical changes in the myelin sheath.[9] This result in demyelination also causes the blockage of the nerve conduction and decrease in conduction velocity. Tobacco affects neural function by various mechanisms. Smoking causes vasoconstriction and damages blood vessels by atherosclerosis, plaque formation so the blood supply and amount of oxygen delivery to the nerve fibers decreases.[10] Smoking also increases cholesterol levels in circulating blood stream which predisposes to the atherosclerosis. Also the higher carboxyhemoglobin levels in the circulating blood found in smokers leads to slowing of nerve conduction by its direct action on myelin sheath.[11] 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. Nicotine present in smoke worsens these effects. [12]

CONCLUSION

From this study we conclude that tobacco consumption is leading to reduction in conduction velocity in sensory fibers of a mixed nerve; sparing its motor fibers. However, the co-relation of blood nicotine levels with the nerve conduction needs further exploration.

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