

Median and ulnar nerve functions in taxi/microbus drivers and helpers in Kathmandu

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Abstract

Background: Occupational drivers are exposed to various stressors such as ergonomic restriction, whole body vibration, vehicle exhaust and dust exposure. Drivers are reported to have higher rates of morbidities, especially of the musculoskeletal and peripheral nervous systems. Reports on drivers' nerve functions by specific electrodiagnostic methods are lacking.

Objectives: To compare electrophysiologic parameters of median and ulnar nerves in drivers with other population.

Methodology: In a cross-sectional comparative study, nerve conduction study was performed in median and ulnar nerves in three groups of participants – Drivers (driving taxi/microbus for at least six months), Helpers (microbus conductors for at least six months) and Controls (college staff/students). Parameters for sensory nerve action potentials and compound motor action potentials were compared among groups by ANOVA and right versus left sides within groups by paired t test.

Results: The study involved 145 male participants – 51 Drivers, 34 Helpers and 60 Controls. Compared to drivers and helpers, conduction velocity of nerves was significantly higher in controls for sensory component of all nerves (p values for right median = 0.001, left median = <0.001, right ulnar = <0.001 and left ulnar = 0.019) and motor component of right ulnar nerve (p=0.002). In right-left comparisons, conduction was slower in left median sensory than right (p=0.001) and right ulnar sensory than left (p=0.015) in the helpers but not significant in other groups.

Conclusion: Electrophysiological evidences of afflictions of median and ulnar nerves are detectable in urban taxi/microbus drivers and helpers with at least six months' occupational duration.

Key words: Driver occupation; Median nerve; Nerve conduction studies; Ulnar nerve.

DOI: <https://doi.org/10.3126/jkmc.v8i3.29722>

INTRODUCTION

Driving job is a highly demanding occupation. Owing to the nature of occupation, drivers (taxi, microbus, bus) are chronically subject to various stressors and bear physical, psychological, and behavioral adverse effects. Spending all the work time within the confines of the driver's cabin or seat, a driver has very little room for flexing and movement of limbs¹. Drivers are exposed to whole body vibration, diesel exhaust and noise while maintaining a high state of vigilance². As a result of these factors, physical health consequences are seen in different organ systems including cardiovascular, gastrointestinal

and musculoskeletal³. Hospital admissions are reported to be significantly higher among professional drivers than the general male working population⁴.

Among many morbidities, disorders of the locomotor/musculoskeletal system and peripheral nerves are most common in the drivers as compared to the general population⁵⁻⁷. For instance, drivers operating all-terrain vehicles are reported to have higher prevalence of pain in the neck and asymmetrical and focal neuropathies as compared to the general population⁸. Taxi drivers with prolonged flexion of elbow and habitually leaning their elbow over the window were reported to have electrophysiologically diagnosable ulnar nerve entrapment neuropathy⁹.

Nerve conduction studies (NCSs) and needle electromyogram (EMG) are very useful in the diagnostic

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evaluation of the peripheral nervous system¹⁰⁻¹². Even subclinical or preclinical nerve conditions are accurately detected by NCS^{13,14}. Thus, the electro-diagnostic tool could prove useful to detect peripheral nerve lesions in the drivers also. In Nepal, some studies have used NCS to assess the functional status of peripheral nerves in some occupations such as tailors and barbers^{15, 16}. Studies on drivers are lacking. This study aimed to assess the upper limb nerves in the drivers; also taking helpers of the vehicles as a study group sharing most of the exposure as drivers.

METHODOLOGY

To test the hypothesis that driver occupation is a risk for affliction of upper limb peripheral nerve function, a cross-sectional case-control observational study was conducted within the period of June to November, 2017 at the Department of Physiology, Nepal Medical College, Kathmandu, Nepal. Participants were recruited based on availability and registered in three categories :

- (1) Drivers, included taxi and microbus drivers engaged in the driver occupation for at least six months;
- (2) Helpers, included staff of the microbus engaged for at least six months in the helper (microbus conductor) occupation; and
- (3) Controls, included students, junior faculties, and staff of the Nepal Medical College and whose vehicle ride per day was limited to transport between residence and college (less than two hours a day).

Subjects engaged in use of any drugs (especially affecting the nervous system), diabetes mellitus, chronic alcohol use, having history of musculoskeletal disorders of the limbs, and heavy physical activities were excluded from participation. Also, records were not taken when having conditions such as common cold, allergies, fever, fasting and exams. The study was approved by the Research and Ethical Committee of Nepal Medical College. Informed written consent was obtained from the participants.

Nerve conduction studies (NCSs)¹⁷⁻²⁰ – Subjects were informed about the procedure, oriented to the laboratory environment and general information including anthropometric measurements taken. Records were done in the afternoon hours (between 12.00 noon and 4.00 PM), with ambulatory laboratory temperature at $26\pm 2^{\circ}\text{C}$. The motor and sensory components were evaluated on the median and ulnar nerves with the NeuroStim[®] Nerve Stimulator (Model NS2: 2 channel, Medicaid Systems, 389, Industrial Area, Ph-II, Chandigarh-160, India; www.medicaid.co.in).

Motor studies were done following the 'belly-tendon montage', with active electrode on the muscle belly (abductor pollicis brevis for median and flexor digiti minimi for ulnar nerve) and stimulation at the wrist (distal) and elbow (proximal) respective to the nerves. Compound motor action potentials (CMAPs) were obtained from supra-maximal stimuli. Sensory studies were done antidromically, recording the sensory nerve action potentials (SNAPs) by the ring electrodes on nerve-respective digits and stimulating at the wrist.

Data analysis was done by SPSS version 16. Differences in the NCS parameters among groups were compared by ANOVA. Right and left sides were compared by paired t test. Level of significance was set at a p-value of 0.05 for all tests.

RESULTS

The study included 145 participants, all males, in three groups – 51 Drivers (35%), 34 Helpers (24%), and 60 Controls (41%). The participant's age ranged from 16 to 50 years. The groups had significant differences for age and anthropometric characteristics (Table 1). Helper group was the youngest and Driver group was the oldest, Control group was the tallest, and Helper group had the lowest weight. Drivers and Helpers had nearly identical height; Drivers and Controls had nearly identical body mass index.

For the sensory components in all the nerves tested (Table 2), the conduction velocities were significantly lower in both the drivers and helpers as compared to controls. For the right ulnar nerve, the Helpers had the slowest conduction and longest latency.

In comparing motor component parameters (Table 3), the CMAP distal latencies were comparable in all groups for all nerves. Similarly, conduction velocities were also comparable, except for the right ulnar which was significantly faster in Controls. For all the nerves, the duration of distal CMAP was the shortest in the Controls but comparable in Drivers and Helpers. Distal CMAP amplitude of the ulnar nerve (both sides) was significantly larger in Controls as compared to other groups.

Right and left comparisons – The conduction velocities of nerves on right and left sides were compared within each group by paired t test (refer to Tables 2 and 3). The only statistically significant differences were observed in the Helper group and for the sensory component. Left median sensory was slower than right ($p=0.001$) while

ulnar sensory was slower on the right side ($p=0.015$). Correspondingly, SNAP latency was longer in left median

and right ulnar nerves ($p=0.016$ and 0.048 respectively), when compared to the other side.

Table 1: General characteristics of different study groups

Characteristics	Driver (n=51)	Helper (n=34)	Control (n=60)	Total (n=145)	ANOVA	
					F value	P value
Age (years)	29.41±6.87	22.09±7.46	24.4±8.18	25.62±7.46	13.098	0.000
Height (cms)	160.41±4.73	160.6±4.99	168.9±6.4	163.97±6.89	40.58	0.000
Weight (Kg)	57.41±9.53	54.73±4.51	65.66±10.32	60.9±9.95	17.11	0.000
BMI (Kg/m ²)	23.07±3.42	21.25±1.89	22.95±2.86	22.59±2.96	4.838	0.009

Table 2: Comparison of different SNAP parameters

Nerve	Study group	Latency ms	Amplitude mV	Velocity m/s
Right Median	Driver	2.54±0.57	22.79±8.62	53.75±9.81
	Helper	2.42±0.4	25.95±13.57	56.59±10.63
	Control	2.48±0.36	23.78±10.15	60.52±8.78
	P value	0.477	0.399	*0.001
Left Median	Driver	2.57±0.62	28.96±13.74	53.8±9.21
	Helper	2.8±0.82	29.43±8.97	50.0±9.95
	Control	2.53±0.42	23.96±10.11	60.01±10.5
	P value	0.1	*0.027	*0.000
Right Ulnar	Driver	2.41±0.63	25.05±11.51	50.68±10.89
	Helper	3.1±1.34	23.37±8.96	42.23±11.73
	Control	2.45±0.77	18.86±9.72	55.94±13.54
	P value	*0.001	*0.005	*0.000
Left Ulnar	Driver	2.37±0.52	21.1±12.01	49.56±9.79
	Helper	2.4±0.63	18.37±10.19	49.11±9.99
	Control	2.45±0.85	20.18±10.52	54.54±11.91
	P value	0.835	0.532	*0.019

Table 3: Comparison of different CMAP parameters

Nerve	Study group	Distal Latency ms	Distal CMAP Amplitude mV	Distal CMAP Duration ms	Velocity m/s
Right Median	Driver	3.17±0.57	17.72±4.68	13.0±1.81	59.33±9.44
	Helper	3.43±0.58	18.56±4.55	13.7±2.32	59.49±7.11
	Control	3.23±0.43	19.65±4.54	11.38±1.36	62.25±7.91
	P value	0.079	0.09	*0.000	0.130
Left Median	Driver	3.36±0.57	18.07±4.83	12.42±2.2	60.88±7.58
	Helper	3.53±0.54	17.2±4.45	13.83±2.24	60.27±8.43
	Control	3.28±0.44	18.85±4.09	11.46±1.67	60.14±5.03
	P value	0.089	0.223	*0.000	0.843
Right Ulnar	Driver	2.47±0.4	12.7±2.55	13.82±3.52	55.98±6.25
	Helper	2.74±0.69	12.56±2.16	13.68±1.91	54.4±6.46
	Control	2.69±0.68	14.79±2.52	12.71±1.96	59.76±8.76
	P value	0.071	*0.000	0.058	*0.002
Left Ulnar	Driver	2.49±0.65	10.62±3.08	14.02±2.88	55.05±7.27
	Helper	2.86±0.82	11.34±1.71	13.95±2.06	55.5±8.44
	Control	2.64±0.83	12.49±2.78	12.39±2.38	56.93±8.12
	P value	0.098	*0.001	*0.001	0.431

DISCUSSION

Public transport drivers (taxi, bus, minibus, microbus) constitute a large occupational group in Nepal²¹. Peripheral nerve dysfunctions and musculoskeletal disorders are reported to be commonly adversely affected in the drivers^{3,4}. This study aimed to electrophysiologically evaluate the median and ulnar nerve functions in taxi and microbus drivers in Kathmandu. NCS parameters, especially nerve conduction velocities of drivers were compared with helpers who have similar occupational exposure and controls.

The principal finding of this study is that drivers and helpers had significantly slower sensory conduction of median and ulnar nerves compared to the controls on both right and left sides. They also had slower motor conduction velocity of right ulnar nerve than in controls. Significant differences in conduction velocities of sensory nerves were also observed in helpers but not in other groups.

For the diagnostic evaluation of a variety of peripheral nerve conditions and even detection of pre-clinical nerve conditions, NCS and needle EMG are regarded as very useful^{11,14}. Most previous studies assessing the occupational risks for nerve and musculoskeletal disorders in drivers are based on tools such as self-reported symptoms, pre-set questionnaires and interviews^{6, 22, 23}. Electrophysiologic evaluation (NCS) has been used scantily probably because the procedure consumes substantial time and effort. In one comparative study, significant slowing of motor conduction was observed in upper and lower limb nerves in drivers (heavy and light vehicles) compared to controls²⁴. However, sensory component was not studied, which is the main finding in our study.

In a study comparing Turkish taxi drivers to controls, Afsar et al have reported decreased sensory as well as motor conduction velocities of the ulnar nerve at the

elbow segment of the side on which drivers habitually lean their elbows over the window⁹. This may suggest a possible explanation for the more marked affection of the nerves in the helpers in this study because helpers, in addition to sharing the traffic and environmental exposure, operate in a different position than the drivers.

In an earlier publication, we had reported that the NCS parameters in our healthy young adult population are comparable to the reference values reported in several other studies²⁶. This provides validity and reliability to the finding in this study. Also, we had observed no significant associations of the parameters with characteristics such as age, height and weight²⁶. Consequently, these factors were not considered in this study.

To facilitate compliance of participants with respect to time and convenience, the NCS procedure was limited to only the upper limbs. Most studies have considered lower limb and other body parts in NCS and symptomatology. The inclusion criteria of at least six months as driver or helper is less compared to occupational duration in other studies. Increasing the occupational duration would have reduced the number of the Helpers who were the youngest of participants.

CONCLUSION

In the drives and helpers in Kathmandu involved in public transport for at least six months, there was a significant reduction in conduction velocity for ulnar and median nerves, especially the sensory component, as compared to healthy controls. Significant differences between right and left sides observed in the helpers suggests possible role of physical constraints to working, in addition to environmental factors.

ACKNOWLEDGEMENTS

We would like to acknowledge the University Grants Commission, Sanothimi, Bhaktapur for granting permission and support to conduct this study.

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