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Work stress hypertension and obesity among professional bus drivers: results of a cross-sectional study conducted in an urban Romanian company of transport

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Abstract

Epidemiological studies have shown that the prevalence of ischemic heart diseases was more frequent in bus drivers. We were interested if driving might contribute to hypertension (HBP) a risk factor for atherosclerosis. In a cross-sectional study, 84 male city bus drivers were followed using ambulatory blood pressure monitoring (ABPM). The difference among the no driving blood pressure (BP) and the driving BP was examined by Student's t-test followed by a logistic regression to explore the predictors for BP rises in driving time. Of the 84 subjects, 22 (26.1%) were hypertensive and took medical treatment. The mean age for both subjects was 44.4 ±7 years. In normotensive subjects mean systolic and diastolic BP were significantly increased from 133.9 mmHg and 79.1 mmHg in no driving period to 143.3mmHg and 89.5 mmHg during driving (p = 0.0001). HBP at ABPM was present during no driving in 35 (56.4%) and during driving in 60 (97%) subjects in the normotensive group. In hypertensive subjects mean systolic and diastolic BP were significantly increased from 138.75 mmHg and 84.25 mmHg in no driving periods to 148.42 mmHg and 94 mmHg during driving (p= 0.0001). Overweight was found in 50%, obesity in 38.09% of subjects, with no difference between groups. Driving increased BP systolic and diastolic averagely with 10/10 mmHg. Among health professionals this research shaved high prevalences of hypertension, overweight and obesity. The control of HBP and excess body weight in this professional group aims to prevent early atherosclerosis development.

Keywords: driving, ambulatory blood pressure monitoring, hypertension, work stress hypertension, overweight, obesity.

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Introduction

Bus drivers represent a professional group with frequently high blood pressure (HBP) and with elevated rates of psychological disorders. Several epidemiological studies have shown higher prevalence of ischemic heart diseases, myocardial infarction, and subsequent mortality rates in this group. Drivers are exposed to multiple risk factors that impact their health including a number of psychosocial work stressors such as job strain (work high in demands and low in control), potentially dangerous environments including both driving and passengers, as well noxious chemicals [1–5].

Objectives

We were particularly interested in the role of work hours as they might contribute to episodic increase of blood pressure (BP). We also studied the predictors for BP rises during driving time.

Material and methods

This was a cross-sectional study carried out in winter 2012 and spring 2013. The study population consisted in 84 male bus drivers who worked for at least one year in Baia Mare City Urban Company Transport (Romania). Bus drivers were driving in different lines, with various traffic jams and different work hours. After completing the informed consent, the drivers were requested to attend to the Cardiology Unit of Emergency City Baia Mare Hospital on a specific date at 8 AM. A cardiologist interviewed the drivers and collected the demographic information and past medical history. All subjects with positive history of diabetes and coronary heart diseases were excluded. A trained nurse measured BP, height and weight of the drivers with standard devices and techniques. The body mass index (BMI) was calculated with the formula weight (kg)/height^2(m) and was classified according to the criteria of the World Health Organization (WHO) as: healthy (<25 kg/m^2), overweight (25 to 29.9 kg/m^2) and obese (≥30 kg/m^2). The nurse measured the individual's blood pressures with both calibrated sphygmomanometer and an Meditech ABPM-04 Ambulatory Blood Pressure Monitoring device (ABPM) in a sitting position, after 5 minutes rest, while the left arm was positioned at the heart level. Meditech ABPM-04 is an validated and recommended device for ambulatory blood pressure monitoring [6]. We considered HBP in the following circumstances: the daytime average ambulatory systolic and diastolic BP measurements more than 135 and/or 85 mmHg, the nighttime (or asleep) average ambulatory systolic and diastolic BP measurements more than 120 and/or 70 mmHg, and the 24-hours average ambulatory systolic and diastolic BP measurements more than 130 and/or 80 mmHg [7]. The correct cuff size was selected and in very large patients a conical shaped cuf was used. BP was measured in both arms and if the systolic blood pressure (SBP) difference was less than 10 mmHg, the ABPM cuff was fixed on the left arm because the bus drivers had to shift the gear using right hand and such a muscular generates make noise on the BP measurements. To ensure the validity, when the ABPM monitoring device was fitted, three readings were recorded simultaneously using a calibrated sphygmomanometer connected to the ABPM device by a Y connector. Average readings for ABPM and sphygmomanometer should not differ by more than 5 mmHg and if it was necessary the cuff was repositioned, or the individual excluded from the study. These measurements were considered as baseline BPs. The ABPM device was programmed to measure the BP every 30 minutes during the day and every 60 minutes during the night. Subjects were instructed to continue with their normal daily activities and to take all their usual medications. All subjects were trained to allow the ABPM to work properly and they were asked to click the event button 5–10 minutes after starting the driving, in order to have accurate BP measurements during their driving periods. Events during the driving were recorded in timetable forms and also the timing of different activities: eating, resting, sleep, taking of medicines, posture and symptoms (*e.g.* dizziness) that may be related to BP. All subjects returned to the clinic on the next day at 8 AM.

Data analysis

The paired t-test was used to assess the difference between the no driving mean systolic BP and the driving mean systolic BP and also between the no driving mean diastolic BP and the driving mean diastolic BP ($p<0.05$ was considered statistically significant). The difference of BP in the two groups (normotensive/hypertensive) was examined by independent t-test. The Spearman's Rho was calculated to examine the relationships between such BP measurements. A logistic regression model accounts the effects of different factors including age, BMI, no driving systolic BP, no driving diastolic BP, no driving mean arterial BP and number of years working as a bus driver on the frequencies of high BP (as dependent variable) in driving time. Data was analyzed by EPI- INFO 7 ™ software.

Results

84 bus drivers completed the study. All were men and relatively young, with an average age of 44 ± 7 years.

The average daily work journey took 10 hours, driving period lasted 6.5 ± 0.5 hours and average distance driven per day was 120 ± 10 km. The average period of working as bus drivers was about 13.3 ±1.5 years. During the study none of the study object have been victims of a traffic accident or victims of assaults by passengers. Of the 84 subjects, 22 took medical treatment and were considered as hypertensives. Drivers in the normotensive group (n=62) were 12 years younger (average 40.58 ± 5 years) than in the hypertensive group (average 53.2 ± 8 years, p=0.001) and had about 0.8 kg/m^2 less BMI (average 29.86) compared with the hypertensive group (average 30.71), but this difference was not statistically significant. Other findings included a higher percentage (88.09%) of drivers with a BMI above adequate levels: overweight was found in 50%, obesity in 38.09% of subjects, with no difference between groups (Table 1). In normotensive subjects, both mean systolic and mean diastolic BPs were significantly increased from 133.9 mmHg (SD 8.7) and 79.1 mmHg (SD 10.2) in no driving period to 143.3mmHg (SD 9.5) and 89.5 mmHg (SD 9.8) during driving (p = 0.0001). In hypertensive subjects, both mean systolic and mean diastolic BP were significantly increased from 138.75 mmHg (SD 8.3) and 84.25 mmHg (SD 7.1) in no driving period to 148.42 mmHg (SD 9.5) and 94 mmHg (SD 8.8) during driving (p = 0.0001). Pulse pressure remained constant, there were no significant differences between no driving and driving time in both groups (p = 0.86) (Table 2). For each bus driver BP was averagely examined 22 times in a working day, and 14 times during driving. BP assessment in the normotensive group (n=62) showed that a 24 hours mean level more than 130 and/or 80 mmHg, were present in 35 drivers (56.4%). These levels are compatible with HBP. During the driving period, 60 (97%)

Table 1. Characteristics of bus drivers from urban company of transport in Baia Mare

Variable (n, %, mean ± SD)	Normotensives (n = 62)	Hypertensives (n = 22)	Total (n = 84)	p*
Age – years (mean ± SD)	40.58 ± 5*	53.2 ± 8*	44.4 ± 7	<0.001
Smokers (n, %)	30 (48.3%)*	10(45.4%)*	40(47.61%)	NS
BMI – kg/m^2 (mean ± SD)	29.86 ± 4.5*	30.71 ± 4.8*	30.12 ± 4.1	NS
Healthy: BMI < 25 (n, %)	7(11.29%)*	3(13.63%)*	10(11.91%)	NS
Overweight: BMI 25–29.9 (n, %)	31(50%)*	11(50%)*	42(50%)	NS
Obese: BMI ≥ 30 (n, %)	24(38.74%)*	8(36.36%)*	32(38.09%)	NS
Mean of driving time / day (h)	6.5 ± 0.5*	6.5 ± 0.5*	–	NS
Mean of driving distance/day (km)	120 ± 10*	120 ± 10*	–	NS
Mean of work as a bus driver (years)	10.5 ± 1.8*	16.2 ± 1.2*	13.3 ± 1.5	<0.01

p*= statistically significant < 0.05; SD – standard deviation; BMI – body mass index

Table 2. Changes of blood pressure and pulse pressure during non-driving and driving in both normotensive and the group of the hypertensives

	Normotensives n = 62	Hypertensive n = 22	Total n = 84
Systolic (mmHg)			
Non-driving period	133.9 ± 8.7	138 ± 8.3	136 ± 7.8
Driving period	143.3 ± 9.5	148.42 ± 9.5	146.3 ±6.9
p-value	<0.0001	<0.0001	<0.0001
Diastolic (mmHg)			
Non-driving period	79.1 ± 10.2	84.25 ± 7.1	81.12 ± 8.5
Driving period	89.5 ± 9.8	94 ± 8.8	91.7 ± 7.7
p-value	<0.0001	<0.0001	<0.0001
Mean BP (mmHg)			
Non-driving period	99.1 ± 5.6	103.3 ± 6.7	101.9 ± 5.8
Driving period	108.9 ± 6.3	112.9 ± 6.4	110.3 ± 6.1
p-value	<0.0001	<0.0001	<0.0001
Pulse pressure (mmHg)			
Non-driving period	54.8 ± 3.3	54.5 ± 3.9	54.8 ± 2.9
Driving period	53.8 ± 3.2	54.4 ± 3.5	54.6 ± 3.1
p-value	0.81	0.96	0.86

p*= statistically significant < 0.05.

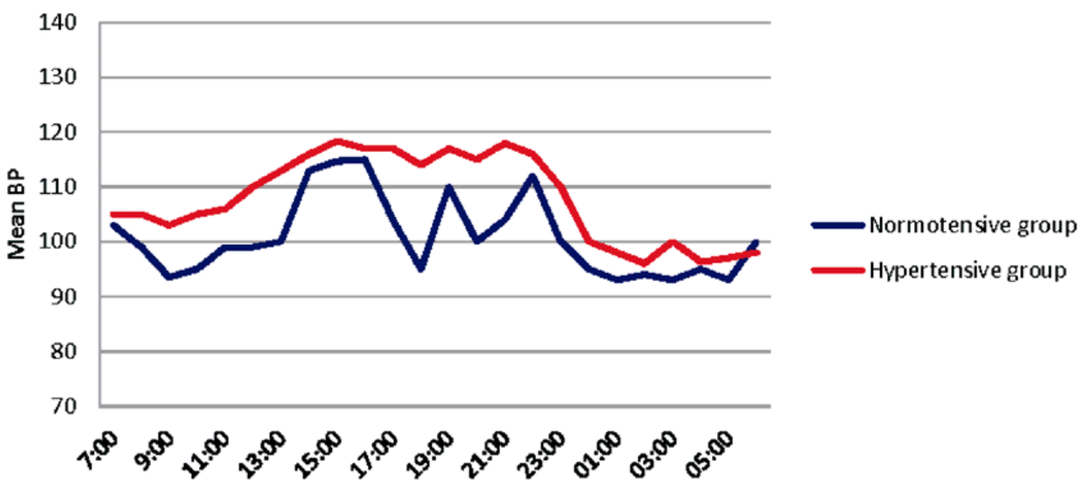

Figura 1. Changes of blood pressure during non-driving and driving in both normotensive and hypertensivegroups.

subjects in the normotensive group developed HBP, with a mean level greater than 135 and/or 85 mmHg [7]. In the hypertensive group (n=22) where subjects were medically treated, the 24 – hours mean BP level was greater than the normal for 13 (58.3%) and during driving for 15 (66.7%). The maximum systolic BP at 179 mmHg in the normotensive group and 206 mmHg in the hypertensive group were registered around 15.30 pm. In the general view, from 7 to 9 AM mean systolic BP decreased slowly in both groups, then it was constant until 11 AM, and rise until 14 PM – Figure 1. Diastolic BP changes were compatible with systolic BP variation during traffic. In the logistic regression model, the frequency of arterial pressure rise during driving and presence of HBP was associated with a BMI higher than 29.6 ± 4.3 kg/m^2 (β= 0.24, p = 0.001) and with no driving systolic BP higher than 135 mmHg (β = 0.19, p = 0.05).

Discussion

Our study showed that driving increases systolic, diastolic and mean arterial BP by about 10 mmHg. Driving has the same effects on systolic and diastolic BP and affects both normotensive and hypertensive subjects. Pulse pressure remains constant in driving compared with no driving period. As expected, frequency of driving hypertension showed a significant association with higher BMI and with no driving systolic BP [8, 9]. Working in the afternoon was associated with the highest hypertension levels in both groups. This observation is compatible with the reports of cardiac vagal tone variation and with cardiac sympathetic tone increases in hypertensive individuals [10]. Bus drivers working in the afternoon were probably affected more adversely by high traffic volume or dealing with an increasing number of passengers waiting the bus or coming home from their work [11]. A study by Greiner and colleagues showed that hypertension in bus drivers from San Francisco City was positively related to age and years of driving: 39% of drivers aged 50 and over were hypertensive, as were 36% of drivers who were bus drivers for more than 20 years [12]. In the same way, bus drivers who were hypertensive in our study have been working as a driver for a longer period (mean 16.2 years) than normotensive drivers (mean 13.3 years) and were also older (average 53.2 ±8 years *versus* 40.58 ± 5 years). The majority of epidemiological studies in countries with long life-expectancy indicate that SBP rises with age [13, 14]. The results of others studies showed that frequencies of elevated BP and electrocardiographic findings increased until age of 45-49 years and decreased thereafter. The results seem to suggest a health based selection among the drivers, the critical age being 45-49 years [15, 16]. Bus drivers in our study have been working as a driver for long period (mean, 13.3 ±1.5 years), which means they had enough time to become well adapted to their work. That is why we assumed that the driving itself did not excite them. They are probably affected more adversely by work-related stressors such as dealing with passengers, looking for potential customers on the roads, traffic jams and noise [17-19]. The effects of noisy environments on BP showed that systolic BP and diastolic BP increase equally in the short-term noise exposures [20]. It can be concluded that the most effects of driving on BP comes from short term and also from long term pattern effects. ABPM assessment in the normotensive group showed presence of HBP in 35 drivers (56.4%) during no driving period and in 60 (97%) during the driving period. Such prevalence in no driving period is comparable with that coming from the Taipei study or from a review involving 22 epidemiological studies that have examined health risks of bus drivers [21, 22]. Our findings suggest that data coming from the medical records or annual physical examinations for bus drivers should be completed by ABPM studies as driving a bus may carry an increased risk to develop HBP. High prevalence levels were found for overweight (50%) and obesity (38.09%), much more higher than in other studies [23-25]. Prolonged exposure to operating a bus (averaged 13.3 ±1.5 years) is associated in our study with HBP and increased BMI and suggests the need of actions to guide these people towards the adoption of a healthier lifestyle. The absence of signs and symptoms makes it difficult to adhere to treatment and modify risk behaviors. We should acknowledge the most important limitations of the study: there was no control group, and the small number of subjects. This research determined, for the first time using an ABPM device, the prevalence of HBP in professional bus drivers in one important Romanian city. Results regarding overweight and obesity exceeds international data for other similar professional groups and, in Romania, data for HBP and BMI are higher than prevalence seen in general population [23-26]. In view of the aspects evidenced in this study, changes in life habits for bus drivers need to be stimulated. On the other hand exposure to the occupation of driving a bus may carry an increased risk of cardiovascular diseases and this professional group need careful assessment of cardiovascular risk factors such as HBP, overweight and obesity.

Conclusions

Driving increased systolic and diastolic BP averagely with 10/10 mmHg in normotensive and hypertensive bus drivers. Among healthy professionals, this research evidenced high prevalence of hypertension, work stress hypertension, overweight and obesity. The control of hypertension and excess body weight in this professional group aims to prevent complications and to avoid early mortality.

Conflict of interest

The authors confirm that there are no conflicts of interest.

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