



## THE CARDIOVASCULAR DISORDERS AND DRIVERS ABILITY

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**Summary:** The goal of this study is to establish the influence of cardiovascular disorders on traffic accidents. 900 drivers were included in this investigation. In this group there were 419 (46.5%) drivers suffering from some cardiovascular disorders: hypertension (24.6%), rhythm disturbance (13%), coronary heart disease (5.3%), and thrombangitis obliterans (3.5%). In the group of professional drivers these diseases are more frequent than in the amateur group. During a 4-year period we kept track of the traffic behavior of 419 drivers with cardiovascular disorders (examination group) and 150 healthy drivers (control group). We noted all traffic accidents caused by their faults. The control and examination group were very similar in other factors which could cause traffic accidents. We observed that drivers from the examination group have caused traffic accidents more often and have had a greater average number of traffic accidents than drivers from the control group. Drivers from the examination group have had longer reaction time to sound and visual stimulation. That could account for why these drivers have had accidents more often. The results of this study suggest the necessity of better health selection of drivers, continuous supervision of drivers and some addition to the Rule book of regulations of the conditions which drivers must satisfy.

**Key words:** Cardiovascular disorders, traffic accidents

### Introduction

The first traffic accident with human victims happened in 1896, only 11 years after the first car had been constructed (1). Because of the rapid progress in auto-industry and the advanced standards of living there's a permanent growth of the vehicles in traffic which leads to higher number of traffic accidents and that is the trend of nowadays (2). For the past 100 years of its existence the automobile was the cause of a great many number of serious problems than the other social factors. Statistical data show that the injuries caused in traffic accidents have a character of "noninfectious epidemic" of the 20<sup>th</sup> century, because they are the fourth place of the "black list" immediately after cardiovascular, pulmonary and malignant disorders. The etiology of traffic accidents is very complex and still not-studied well. A lot of factors could be responsible for but the human factor and the health condition of the drivers considerably influence the traffic accidents are always dominating (3, 4). The small number of studies deals with the problem of the influence of cardiovascular system on traffic accidents. Mostly,

all the examinations are related to sudden deaths in cars caused by myocardial infarction (5). Whereas, the presence of those, suffering from cardiovascular disorders in accidents without any death results, is not sufficiently examined.

The aim of this study is to establish the influence of cardiovascular disorders (CVD) on traffic accidents.

### Patients and Methods

According to the Law on Traffic Safety (further in the text LTS) on the basis on whose data the Rule book was developed, containing conditions drivers must satisfy the medical board examined 900 drivers (600 amateurs and 300 professionals) during the 1991 at the Institute for Occupational health in Niš. The members of this medical board were: cardiologists, psychiatrists, otorhinolaryngologists, ophthalmologists and specialists in occupational health.

Applying all the necessary diagnostic methods and tests in discovering all the conditions and illnesses which could affect the driver's condition and giving opinion about the problem the medical board diagnosed some CVD at 419 drivers (6).

Diagnosis of the *arterial hypertension* was confirmed after the high blood pressure had been found in 3 measurements in a row. Systolic blood pressures over 18.7kPa and diastolic blood pressures over 12.0kPa were considered like arterial hypertension (7). The very measurements were carried out according to all postulates of the technique of measurement.

Diagnosis of *coronary heart disease* was established after the clinical observation, ECG, exercise testing and echocardiography examination. In some cases it was confirmed by angiography.

Diagnosis of *rhythm disturbances* was established after the clinical observation, ECG and exercise testing had been done.

Diagnosis of *thrombngitis obliterates* was established after clinical observation and ehosonografy of legs' blood vessels had been done.

According to Rule book the diagnosed disorders are not contraindications for driving, they only demand the limited duration of driving license after which drivers must take psychical examination in

order to estimate health condition for driving. The *examination group* consisted of 419 drivers

The *control group* consisted of 150 completely healthy drivers who were capable of driving, according to the medical board.

During the 4-years period we kept track of traffic behavior of these drivers and noted all traffic accidents caused by their faults.

Statistical data processing was fulfilled.

## Results

900 drivers took physical examination and some cardiovascular disorders were found at 419 (45.5%) drivers. The arterial hypertension has been represented by 24.6%, rhythm disturbances by 13 % and thrombngitis obliterates by 3.6% (Table 1). The most frequent duration of these diseases was 16-20 years (Table 2).

We tried to find incidence of the cardiovascular disorders in the group of amateurs and in the group of professionals. The arterial hypertension's frequency has been 38.3% and rhythm

Table 1. Incidence of cardiovascular disorders in group of drivers with limited driving license

	N	Number	%
Arterial hypertension	900	222	24.60
Coronary heart disease			
• Total	900	48	5.30
• Chronic myocardial infarction	900	29	3.20
• Angina pectoris stabiles	900	19	2.10
Thrombngitis obliterans	900	32	3.50
Rhythm disturbances			
• Total	900	117	13.00
• Ventricular extrasystole	900	27	3.00
• Atrial fibrillation	900	26	2.90
• Paroxysmal tachycardia	900	20	2.20
• Atrioventricular block	900	23	2.60
• Block of Hiss band	900	21	2.30
Total	900	419	46.50

Table 2. The duration of the cardiovascular diseases in group of drivers with limited driving license

	Years										Total	
	<5		6-10		11-15		16-20		>20		N	%
	N	%	N	%	N	%	N	%	N	%		
Arterial hypertension	42	18.9	41	18.5	44	19.8	45	20.3	50	22.5	222	100
Coronary heart disease												
• Total	10	20.8	9	18.7	11	22.9	8	16.7	10	20.8	48	100
• Chronic myocardial infarction	6	20.6	7	24.1	5	17.2	4	13.8	7	24.1	29	100
• Angina pectoris stabiles	4	21.1	2	10.5	6	31.6	4	21.1	3	15.8	19	100
Thrombngitis obliterans	6	18.7	8	25.0	5	15.6	7	21.8	6	18.7	32	100
Rhythm disturbances												
• Total	29	24.8	23	19.6	25	21.4	28	23.9	12	10.2	117	100
• Ventricular extrasystole	4	14.8	5	18.5	7	25.9	6	22.2	5	18.5	27	100
• Atrial fibrillation	6	23.1	7	26.9	3	11.5	8	30.7	2	7.7	27	100
• Paroxysmal tacchycardia	3	15.0	3	15.0	6	30.0	5	25.0	3	15.0	26	100
• Atrioventricular block	8	34.8	4	17.4	7	30.4	3	13.1	1	4.3	20	100
• Block of Hiss band	8	38.1	4	19.1	2	9.5	6	28.6	1	4.8	23	100
Total	87	20.7	81	19.3	85	20.3	88	21.0	78	18.6	21	100

disturbances frequency has been 19.3 % in the group of professionals (Table 3). This has statistical signification in comparison with the control group ( $p < 0.001$ ).

The drivers' average age was  $51.8 \pm 12.3$  years at the examination group and  $52.1 \pm 11.9$  years at the control group. This is not of the statistical importance. The control and examination group were very similar about other factors which could cause traffic accidents (Table 4).

We observed that the drivers from the examination group caused traffic accidents more

often (22.4%) than the control group (10.6%) during a 4-years period. The same relations were observed at groups of drivers with arterial hypertension and thrombangitis obliterans in comparison with the control group. Those facts have statistical signification (Table 5). The greatest number of drivers causing accidents was in a subgroup with the duration of cardiovascular disease over than 20 years (Table 6).

We observed the average number of traffic accidents caused by a single driver. The examination group had a greater average number

Table 3. Incidence of cardiovascular disorders in groups of professionals and amateurs

	Amateurs (N=600)		Professionals (N=300)	
	number	%	number	%
Arterial hypertension	107	17.8	115	38.3
Coronary heart disease				
• Total	29	4.8	19	6.3
• Chronic myocardial infarction	16	2.7	13	4.3
• Angina pectoris stabilis	13	2.2	6	2
Thrombangitis obliterans	21	3.5	11	3.7
Rhythm disturbances				
• Total	59	9.8	58	19.3
• Ventricular extrasystole	1	0.2	26	8.7
• Atrial fibrillation	13	3.2	13	4.3
• Paroxysmal tachycardia	18	3	2	0.7
• Atrioventricular block	10	1.7	13	4
• Block of Hiss band	17	2.8	4	1.3
Total	216	36	203	67.7

Table 4. Structure of examination and control group

	Examination group		Control group	
	number	%	number	%
Men	290	69.2	106	70.6
Smokers	249	59.4	89	59.3
Married	199	47.5	71	47.3
Unmarried	149	35.6	53	35.3
Divorced	71	16.9	26	17.3
Driving experience up to 1 year	37	8.8	12	8
Driving experience 2- 5 years	106	25.3	40	26.7
Driving experience 5- 10 years	115	27.4	41	27.3
Driving experience over 10 years	161	38.4	57	38

Table 5. Number of drivers that caused traffic accidents

	N	Number	%
Control group	150	16	10.6
Examination group	419	94	22.4 <sup>xxx</sup>
Arterial hypertension	222	62	27.9 <sup>xxx</sup>
Coronary heart disease			
• Total	48	7	14.6
• Chronic myocardial infarction	29	6	20.7
• Angina pectoris stabiles	19	1	5.3
Thrombangitis obliterans	32	11	34.3 <sup>xx</sup>
Rhythm disturbances			
• Total	117	14	11.9
• Ventricular extrasystole	27	2	7.4
• Atrial fibrillation	26	1	3.8
• Paroxysmal tachycardia	20	2	10
• Atrioventricular block	23	6	26.1
• Block of Hiss band	21	3	14.3

xxx  $p < 0.001$

xx  $p < 0.01$

of traffic accidents ( $2.4 \pm 0.7$ ) than the control group (Table 7). Those have statistical significance too ( $p < 0.001$ ).

The examination group had a longer reactive time on the visual and acoustic stimulation (Table

8). Drivers suffered from arterial hypertension, coronary heart disease and thrombongitis obliterans had a longer reactive time and that's statistically important.

Table 6. Numbers of drivers that caused traffic accidents in ratio to duration of cardiovascular diseases

	Years										Total	
	<5		6-10		11-15		16-20		>20			
	N	%	N	%	N	%	N	%	N	%	N	%
Arterial hypertension	42	9.5	41	12.2	44	15.9	45	28.9	50	66	222	87.9
Coronary heart disease												
• Total	10	0	9	0	11	18.2	8	25	10	30	48	14.5
• Chronic myocardial infarction	6	0	7	0	11	18.2	4	0	7	42.8	29	20.7
• Angina pectoris stabiles	4	0	2	0	15	20	4	0	3	33.3	19	5.3
Thrombongitis obliterans	6	16.6	8	12.5	5	20	7	42.8	6	83.3	32	34.3
Rhythm disturbances												
• Total	29	6.9	23	8.7	25	8	28	10.7	12	41.6	117	11.9
• Ventricular extrasystole	4	0	5	0	7	0	6	0	5	40	27	7.4
• Atrial fibrillation	6	0	7	0	3	0	8	0	2	50	26	3.8
• Paroxysmal tachycardia	3	0	3	0	6	0	5	20	3	33.3	20	10
• Atrioventricular block	8	12.5	4	50	7	27.8	3	0	1	100	23	26.1
• Block of Hiss band	8	12.5	4	0	2	0	6	33.3	1	0	21	14.3
<b>Total</b>	<b>87</b>	<b>8.1</b>	<b>81</b>	<b>9.8</b>	<b>85</b>	<b>14.1</b>	<b>88</b>	<b>23.8</b>	<b>78</b>	<b>58.9</b>	<b>419</b>	<b>22.4</b>

Table 7. The average number of traffic accidents caused by single driver

	N	Number	±	SD
Control group	150	0.8	±	0.1
Examination group	419	2.4	±	0.7
Arterial hypertension	222	2.9	±	0.9
Coronary heart disease				
• Total	48	2.8	±	0.8
• Chronic myocardial infarction	29	3.1	±	0.8
• Angina pectoris stabiles	19	1	±	0.6
Thrombongitis obliterans	32	3.1	±	1.1
Rhythm disturbances				
• Total	117	1.2	±	0.1
• Ventricular extrasystole	27	1.4	±	0.09
• Atrial fibrillation	25	1	±	0
• Paroxysmal tachycardia	20	1.3	±	0.09
• Atrioventricular block	23	1.1	±	0.1
• Block of Hiss band	21	1.3	±	0.1

\*\*\*  $p < 0.001$

Table 8. Reaction time to acoustic and visual stimulation

	N	Acoustic stimulation ± SD		Visual stimulation ± SD	
Control group	150	0.17	± 0.01	0.23	± 0.05
Examination group	419	0.18	± 0.02	0.25	± 0.07
Arterial hypertension	222	0.20	± 0.03	0.25	± 0.08
Coronary heart disease					
• Total	48	0.19	± 0.01	0.25	± 0.07
• Chronic myocardial infarction	29	0.20	± 0.02	0.26	± 0.08
• Angina pectoris stabiles	19	0.17	± 0.01	0.23	± 0.05
Thrombongitis obliterans	32	0.20	± 0.02	0.26	± 0.05
Rhythm disturbances					
• Total	117	0.17	± 0.01	0.24	± 0.08
• Ventricular extrasystole	27	0.17	± 0.01	0.24	± 0.09
• Atrial fibrillation	25	0.17	± 0.01	0.23	± 0.01
• Paroxysmal tachycardia	20	0.18	± 0.02	0.24	± 0.2
• Atrioventricular block	23	0.17	± 0.02	0.24	± 0.01
• Block of Hiss band	21	0.16	± 0.04	0.25	± 0.9

\*\*  $p < 0.01$

\*\*\*  $p < 0.001$

## Discussion

The results of this study show that cardiovascular disorders are very frequent among the drivers population, especially at the professional group. That's probably because they're chronically exposed to stress factors, noise, vibration, bad climate conditions, long driving, separation from home and family, small physical activity, irregular nutrition etc. (8, 9).

The Rule book contraindications for driving are issued but they are very similar for the professionals and amateurs. The only difference is that for the professionals contraindications are slight ailments and for the amateurs they are the serious form of the same disease.

The contraindications for drivers with *arterial hypertension* are:

- disease with diastolic pressure more than 16.0 kPa with complications on retinal, brain, coronary and renal blood vessels.

The results of this article show that the drivers with diastolic blood pressure between 12.7-16.0 kPa and without clinical signs of complications, cause traffic accidents more often. Clinically unmanifested cardiocerebral vascular complications, often changes of blood pressure or characteristic changes of personality of hypertensives could explain these (10). These could be important factors for drivers' ability reduction. The problem of drug therapy is also very actual. Some antihypertensive drugs cause vertigo, sleepiness, reduce attention, cause longer reaction time and changes of mental work capacity and psychological status (11, 12). Frequent changes of blood pressure (sudden increasing and decreasing) have influence on drivers' security too. Because of that we suggest that drivers must control their blood pressure during the therapy and driving activity. That should be routine matters in evaluation of drivers' ability.

The contraindications for drivers with *coronary heart disease* are:

- serious cases of coronary diseases with attacks of angina pectoris
- myocardial infarction until six months (amateurs) and minimum six months (professionals) after it if they have no pain attacks or rhythm disturbances.

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The results of this study show that drivers with "slight ailment" coronary heart disease and those when more than six months passed from myocardial infarction, cause a greater number of traffic accidents than the control group. Pain attacks during the driving and atherosclerotic changes in blood vessels of peripheral nervous system which cause longer reactive time could be the explanation for our results.

The contraindications for drivers with *rhythm disturbances* are :

- atrioventricular blocks of the second and third degree and
- left branch blocks.

Other rhythm disturbances indicate only frequent examination (6). The results of our study show that rhythm disturbances could be an important factor in traffic accidents.

The contraindications for drivers with *thrombangitis obliterates* are later stadiums of disease (6). In our study the results show that drivers in the first stages of this disease cause traffic accidents more than at the control group. Transient spasms of legs' blood vessels which cause fears, subjective difficulties and reduce mobility and reactive time (proved by the longer reactive time on stimulation) could be the explanation for these results.

## Conclusions

The results of our study show that cardiovascular disorders are very frequent among drivers population.

On the basis of the facts given in this study one can observe that drivers with arterial hypertension, coronary heart disease, rhythm disturbances and thrombangitis obliterates cause traffic accidents more often than healthy drivers. These results suggest the necessity of better health selection of drivers by previous and periodic examinations.

Also, there is the necessity of continuous supervision of drivers and their health, especially those ones who cause traffic accidents more often than the others.

We need some addition in Rule book of health conditions which drivers must satisfy.

That will be contribution on prevention of traffic accidents.

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## KARDIOVASKULARNA OBOLJENJA I VOZA^KA SPOSOBNOST

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*Kratak sadrzaj:* Cilj rada je utvrdjivanje prevalencije i uticaja oboljenja kardiovaskularnog sistema na nastajanje saobra}ajnih nezgoda. Ispitivanjem je obuhva}eno 900 voza-a. U ovoj grupi je utvr}eno da 419 (46.5%) voza-a boluje od nekog oboljenja kardiovaskularnog sistema medju kojima dominira arterijska hipertenzija (24.6%), poreme}aji sr-anog ritma (13%), koronarna bolest (3.5%) i thrombangitis obliterans (3.5%). Ova oboljenja su zna-ajno -e{a kod voza-a profesionalaca u odnosu na amatere. U toku -etvorogodi{njeg perioda pra}eno je pona{anje 419 voza-a sa oboljenjima kardiovaskularnog sistema (ispitivana grupa) i 150 zdravih voza-a (kontrolna grupa) u saobra}aju pri -emu su evidentirane sve saobra}ajne nezgode na-injene krivicom ovih voza-a. Ispitivana i kontrolna grupa su bile pribli`no iste po pitanju drugih faktora koji uticu na saobra}ajne nesre}e. Zapa`eno je da voza-i ispitivane grupe statisti-ki zna-ajno -e{e izazivaju saobra}ajne nezgode i imaju zna-ajno ve}i prose-an broj saobra}ajnih nezgoda u odnosu na voza-e kontrolne grupe. Kod voza-a ispitivane grupe utvrdjeno je i statisti-ki zna-ajno du`e vreme reakcije na akusti-ine i vizuelne dra`i {to mo`e predstavljati delimi-no obja{njenje za -e{u pojavu nezgoda kod ovih voza-a.

Rezultati ovog rada name}u potrebu bolje zdravstvene selekcije voza-kog kadra, stalno pra}enje voza-a u saobra}aju i dopunu Pravilnika o zdravstvenim uslovima koje voza-i moraju ispunjavati.

*Klju-ne re-i:* Kardiovaskularna oboljenja, saobra}ajne nesre}e

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