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WORK PERFORMANCE EVALUATION IN PATIENTS SUFFERING FROM HYPERTENSION

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In 41 patients suffering from hypertension blood pressure values obtained in routine examinations in an outpatient clinic were analysed by correlating the highest values of blood pressure measured using the 24-hour monitoring model developed by Holter and those obtained in exertion tests developed by Bruce. The correlation coefficients indicated poor correlation. The results proved the author's hypothesis that it was not possible to predict blood pressure development in 24-hour monitoring based on values of blood pressures obtained in routine outpatient practice only nor could these values be used for the assessment of work performance. It can be concluded that individual functional testing of patients suffering from hypertension is the best method for assessing their work performance.

Key terms:
assessment of work performance, exertion test, 24-hour
monitoring

Hypertension, a disease and risk factor, is a public health-related problem with approximately 10 per cent morbidity in the Croatian population (1, 2). The incidence of the disease in the physically active population is rather high and, therefore, has very large economic implications. The disease, which is insufficiently clear in terms of aetiology, is the result of interaction between hereditary tendencies and environmental factors including occupational setting. Psychic and physical strains as well as their interaction during working life undoubtedly affect the incidence and development of hypertension in persons with a predisposition to the disease (3, 4). In routine examinations in outpatient clinics, the disease is diagnosed on the basis of blood pressure recordings made in the physician's office.

The term "white-coat hypertension", referred to a long time ago (5), is described as elevated blood pressure recorded during consultations with a physician

in persons who usually have normal blood pressure measurements elsewhere (6). According to some authors, the incidence is between 20 and 30 per cent (7), although an occurrence of as high as 55 per cent has also been reported (8). The pioneers in the application of a 24-hour monitoring programme informed on a series of results in blood pressure development under varied living and working conditions. They pointed out that there was a clear distinction between blood pressure measurements recorded in clinical practice and those obtained by using the 24-hour monitoring programme outside the clinic (9-11). Therefore, the question can be raised whether it is possible to diagnose and treat hypertension or assess work performance only on the basis of blood pressure measurements made in routine examinations in an outpatient clinic.

The hypothesis of this study was that blood pressure development cannot be predicted in 24-hour monitoring nor work performance assessed only on the basis of blood pressure values obtained in routine outpatient practice.

SUBJECTS AND METHODS

The study sample consisted of 41 workers who underwent special periodical medical tests in the Split Medical Centre. The workers held various jobs and worked under special working conditions implying psychic strain and/or moderately heavy physical strain (professional drivers, physicians, dentists, building machinery operators and transport workers). Only those who were found to suffer from hypertension were included. When hypertension was detected, the patients were grouped according to age and sex.

Hypertension was diagnosed on the basis of past medical records and three successive measurements at one-week intervals using a standard sphyngomanometer on both arms in three different positions: sitting, lying down and standing up. A person whose average blood pressure was above 140/90 mm Hg (according to the criteria of the WHO Expert Committee, 1978) was considered to be hypertensive (12-14).

The study took into account detailed family, occupational and health histories. The subjects underwent a routine examination in the physician's office, laboratory tests and other diagnostics-related tests according to respective hypertensive algorithm (15): blood, urine with specific gravity, glucose in blood, creatinine, potassium. The tests were carried out in the Central Laboratory of the Public Health Centre, Split. Chest electrocardiography and teleroentgenography were also performed along with examination of the eye fundus.

Having completed routine examinations and diagnostics-related tests the subjects underwent 24-hour monitoring after Holter during which they performed their usual daily activities. They were also instructed to note down all their mental and/or physical activities during monitoring. The day following the removal of the Holter monitor, physical strain was additionally examined by means of an

exertion test on a treadmill using the Bruce protocol. During this time pressure was recorded every three minutes, at up to 15-minute intervals after completion of the exertion test.

From the blood pressure values measured in the physician's office a mean value was calculated. This value was correlated with the highest values of systolic and diastolic blood pressures obtained by monitoring and the highest values obtained in the exertion test. The correlation coefficients were tested by t-test ($P < 0.05$). Regression analysis was carried out in order to enable a more detailed prognosis from regression variables. The results are given graphically.

RESULTS

The subjects in the study were 41 hypertensive patients: two women and 39 men aged 52.1 ± 8.6 years. Of the total number, 13 were fairly, 13 moderately and 15 heavily hypertensive, according to the WHO criteria as modified by Julius (15).

The average value recorded in routine outpatient practice was 171.77 ± 21 mm Hg for systolic blood pressure and 111.96 ± 35 mm Hg for diastolic pressure. The highest values of systolic pressure during monitoring supposing normal daily activities averaged 156.24 ± 22.22 mm Hg; those of diastolic pressure averaged 107.75 ± 16.11 mm Hg. The highest values of systolic pressure during psychic strain averaged 155.49 ± 18.09 mm Hg whereas those of diastolic pressure averaged 108.02 ± 16.03 mm Hg. The highest values during the exertion test averaged 189.39 ± 28.37 mm Hg for systolic and 108.66 ± 12.84 mm Hg for diastolic pressure.

In eight hypertensive patients (19%) elevated blood pressure was registered only at the time the Holter monitor was put on and taken off. Hypertensive reaction to strain during the exertion test was registered in 17 patients (41%).

In 22 patients (54%), an aortic and hypertrophied heart configuration was noted in the teleroentgenogram. The beginning of sclerotic changes in the blood vessels of the eye fundus was observed in 16 patients (39%). Only two showed signs of the left ventricle hypertrophy in the electrocardiogram. The other findings were normal in all the patients.

Figures 1 and 2 show correlation and regression between the values obtained in routine examinations in an outpatient clinic and the highest values of systolic and diastolic pressures during the exertion test. The correlation between the highest value of systolic pressure during the exertion test and the average systolic pressure was statistically significant (Figure 1).

Figures 3 and 4 show correlation and regression between the values of systolic and diastolic pressures obtained in routine examinations in an outpatient clinic and the highest values obtained by monitoring during psychic strain. Again, the correlation coefficient for systolic pressure measurements was statistically significant (Figure 3).

Figures 5 and 6 show correlation and regression between the values of systolic and diastolic pressures obtained in routine examinations in an outpatient clinic

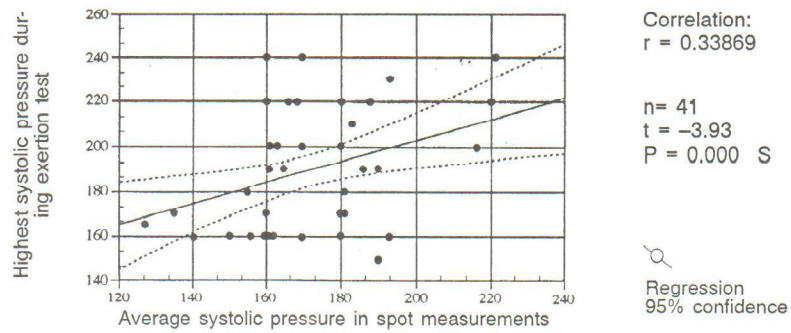


Figure 1 Correlation between values of systolic pressure obtained in routine outpatient examinations and the highest values obtained on a treadmill

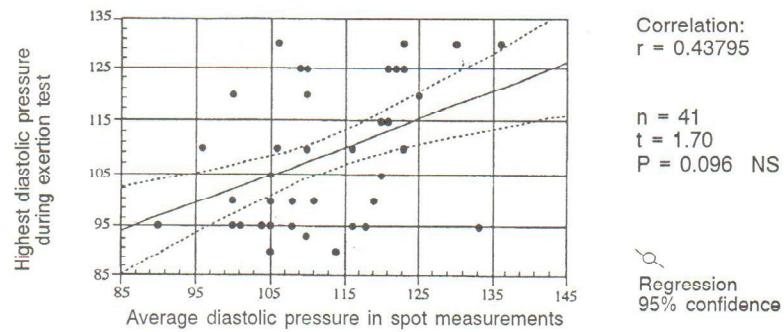


Figure 2 Correlation between values of diastolic pressure obtained in routine outpatient examinations and the highest values obtained on a treadmill

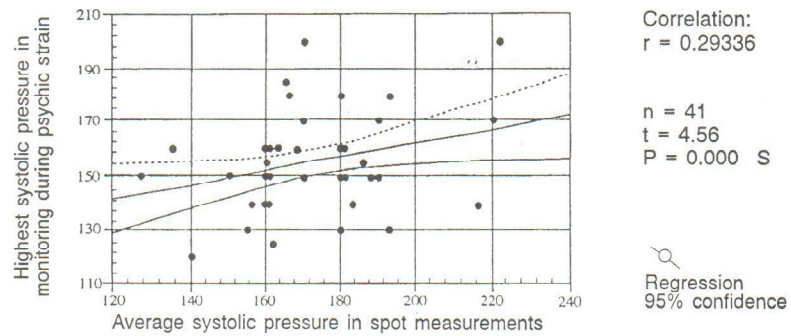


Figure 3 Correlation between values of systolic pressure obtained in routine outpatient examinations and the highest values obtained in monitoring during psychic strain

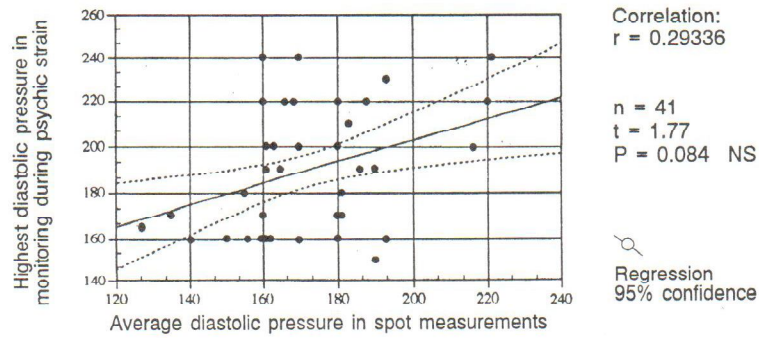


Figure 4 Correlation between values of diastolic pressure obtained in routine outpatient examinations and the highest values obtained in monitoring during psychic strain

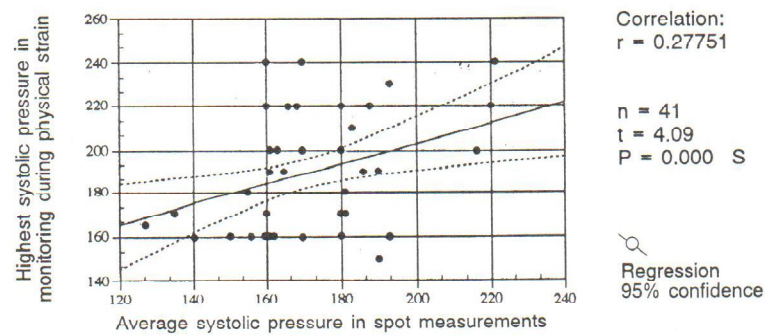


Figure 5 Correlation between values of systolic pressure obtained in routine outpatient examinations and the highest values obtained in monitoring during physical strain

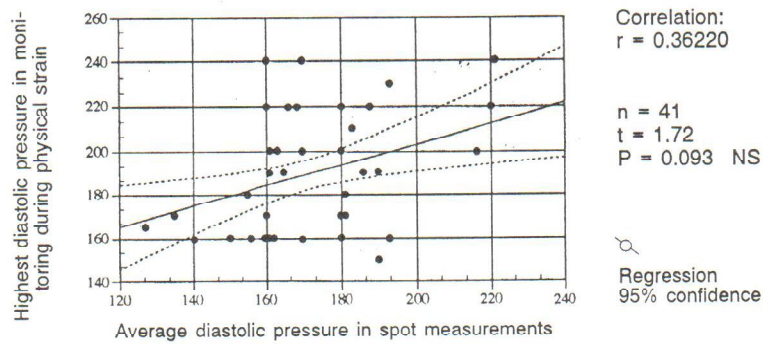


Figure 6 Correlation between values of diastolic pressure obtained in routine outpatient examinations and the highest values obtained in monitoring during physical strain

and the highest values obtained by monitoring during physical strain. The correlation coefficient obtained for systolic pressure was statistically significant (Figure 5). No statistically significant correlation was found between average diastolic blood pressure and any highest diastolic pressure value (Figures 2, 4, 6).

DISCUSSION

Results show that blood pressure (systolic and diastolic) values obtained in routine outpatient practice could not be used to predict blood pressure development because the correlation coefficients were rather low (between 0.3 and 0.4). Similar results were reported by *Mancia* (16, 17). Although the mean blood pressure values, as calculated from the values obtained by monitoring while the subjects performed some physical activity, were lower than the mean values obtained in routine outpatient examinations, 15 of our subjects experienced elevated blood pressure during monitoring solely because of psychic stress. The stress was described in the notes as follows: heated argument during staff meetings, argument with boss, complications while having a tooth extracted, anger while watching TV.

Folkow (19) and *James* (20) showed that emotional stress, as a chronic occupational factor in jobs with high mental demands, greatly contributed to hypertensive pathogenesis in persons predisposed to develop hypertension. Similar results were reported by *Light and co-workers* (3), by *Schnall and co-workers* (21) and *Karasek and co-workers* (22). Such persons should undergo individual functional testing, after which the best solution is to change the stress-related workplace environment. It is well known that elevations of blood pressure can be successfully prevented by change of environment. This also has a direct impact on cardiovascular morbidity and mortality by inducing a decrease which cannot be normally achieved by any antihypertensive therapy (23-25).

The fact that elevated blood pressure was recorded in 19 per cent of our patients while they were putting on and taking off the monitor, was similarly reported by *Pickering and co-workers* (7) and *Hoegholm* (26). The phenomenon of "white-coat hypertension" (pressure response to the physician's presence) may greatly affect the blood pressure values in routine outpatient examinations thus making the diagnosis and work performance evaluation unreliable in hypertensive patients (27-29). Individual reaction to psychic and physical stress-related factors was also reported by *Parati and co-workers* (30).

The highest values of systolic and diastolic pressures during monitoring and physical strain were lower on the average than the pressure values measured in the physician's office. It can be concluded that exposure to physical strain was not contraindicative in all hypertensive subjects, but, on the contrary, in certain cases it could be recommended as therapy. Only 10 of our subjects were found to have elevated blood pressure during monitoring while performing some physical activity and 17 had hypertensive reactions to physical strain during

the exertion test. Therefore, in these cases, exposure to physical strain was inadvisable. Such a reaction to physical strain was attributed to a heavy state of hypertension (1, 18).

CONCLUSIONS

- Correlation between blood pressure values obtained in routine examinations in an outpatient clinic and the highest values of blood pressure obtained during exertion tests was poor.
- Correlation between blood pressure values obtained in routine outpatient examinations and the highest values of blood pressure obtained during monitoring assuming performance of mental and physical activities was poor.
- It was not possible to predict blood pressure development during 24-hour monitoring or to assess work performance on the basis of blood pressure values obtained in routine outpatient examinations.
- In conclusion, individual functional monitoring of blood pressure values during normal physical activities of patients suffering from hypertension is the best method for assessing their work performance.

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Sažetak

Ocjena radne sposobnosti kod hipertenzije

Vrijednosti kliničkog tlaka, izmjerene ambulantno u 41 hipertoničara, korelirane su s njihovim najvišim očitanim vrijednostima tlaka tijekom 24-satnog praćenja po Holteru i s najvišim očitanim vrijednostima tijekom testa opterećenja po Bruceu. Cilj je bio pokazati da kliničke vrijednosti tlaka, izmjerene ambulantno, nisu dobar prediktor za kretanje tlaka tijekom 24-satnih dnevnih aktivnosti, pa ni za ocjenu radne sposobnosti. Dobiveni koeficijenti korelacije između

kliničkih vrijednosti sistoličkih i dijastoličkih tlakova i najviših vrijednosti sistoličkih i dijastoličkih tlakova tijekom praćenja i u testu opterećenja na pokretnom sagu, testirani na značajnost t-testom, pokazuju slabu korelaciju (svi su niži od 0,50 uz $P < 0,05$). Rezultati pokazuju da vrijednost kliničkog tlaka nije dobar prediktor za kretanje vrijednosti tlaka tijekom 24-satnih dnevnih aktivnosti, pa time ni za ocjenu radne sposobnosti. Individualno funkcionalno ispitivanje najbolji je pristup u svrhu ocjene radne sposobnosti hipertoničara.

Cljučne riječi:

ocjena radne sposobnosti, test opterećenja, 24-satno praćenje

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