

Blood pressure changes in residents with and without a night on call at emergency room: a cross-sectional study

Alterações da pressão arterial em residentes com e sem plantão noturno em serviço de emergência: um estudo transversal

Aida Cristina Suozzo¹, Roberto Alexandre Franken², Stella Maria Malta³, Shirley Silva Lacerda⁴, Ronaldo Fernandes Rosa⁵, Luiz Antonio Nogueira-Martins⁶

Abstract

Background: Increased blood pressure has been associated with night work; however, this trend has not been extensively explored in residents. **Objective:** The aim of this study was to compare ambulatory blood pressure monitoring (ABPM) data from first-year internal medicine residents over 24h periods that included a 12h night duty shift in the emergency room and another workday not involving night duty. **Methods:** A cross-sectional study was performed involving 38 residents with a mean age of 25.4 years. The ABPM was carried out using an oscillometric method (Spacelbs™ monitor) over 24h, and data was collected from each resident during a night call shift (Stage1) and during an off-duty night (Stage2). **Results:** The means values of systolic and diastolic blood pressure were significant difference during daytime (118 v 115 mmHg, $p < 0,001$; 75 v 71 mmHg, $p=0.01$) and nighttime (116 v 108 mmHg, $p < 0,001$; 74 v 64 mmHg, $p < 0,001$) in Stage 1 than Stage 2. Only at stage 2 there was difference

between daytime and nighttime at blood pressure systolic (115 v 108 mmHg, $p < 0,001$) and diastolic (71 v 64 mmHg, $p < 0,001$). 76% of the residents did not presented nocturnal BP fall at Stage 1. **Conclusions:** The blood pressure behavior in residents during a 24h work shift suggesting that may be related to occupational stress.

Keywords: Clinical clerkship; Internship and residency; Education, medical; Night work; Blood pressure; Hypertension

Resumo

Introdução: O aumento da pressão arterial tem sido associado ao trabalho noturno, no entanto, esta tendência não tem sido muito explorada em residentes. **Objetivo:** O objetivo deste estudo foi comparar os dados da monitorização ambulatorial da pressão arterial (MAPA) de residentes de primeiro ano de clínica médica durante períodos de 24h que incluíram 12h de plantão noturno em serviço de emergência e outra jornada de trabalho sem plantão noturno. **Métodos:** Um estudo transversal foi realizado com 38 residentes com idade média de 25,4 anos. A MAPA foi realizada utilizando método de aferição durante 24h (TM Spacelbs monitor) e os dados foram coletados de cada residente durante um plantão noturno (Etapa1) e durante uma noite de descanso (Etapa2). **Resultados:** As diferenças entre as médias de pressão arterial sistólica e diastólica foram estatisticamente significativas durante o período diurno (118 v 115 mmHg, $p = 0,01$; 75 v 71 mmHg, $p < 0,001$) e noturno (116 v 108 mmHg, $p < 0,001$; 74 v 64 mmHg, $p = 0,00$) tanto na Etapa 1 quanto na Etapa 2. Apenas na Etapa 2, houve diferença entre os períodos diurnos e noturnos na pressão arterial sistólica (115 v 108 mmHg, $p < 0,001$) e diastólica (71 v 64 mmHg, $p < 0,001$). 76% dos residentes não apresentaram descenso noturno na Etapa1. **Conclusões:** O comportamento da pressão arterial em residentes durante turno de 24h de trabalho sugere que pode estar relacionado ao estresse ocupacional.

Descritores: Estágio clínico, Internato e residência, Educação médica, trabalho noturno, Pressão arterial; Hipertensão

1. Emergency Room of Hospital Central of Irmandade da Santa Casa de Misericórdia de São Paulo (ISCMSP). Santa Casa Medical School of São Paulo - Department of Psychiatry and Medical Psychology

2. Head Professor in Santa Casa Medical School of São Paulo. Department of Internal Medicine

3. Interdisciplinary Clinical Neurosciences Laboratory, Department of Psychiatry, Universidade Federal de São Paulo (UNIFESP)

4. Núcleo de Estatística e Metodologia Aplicada, Department of Psychiatry, Universidade Federal de São Paulo (UNIFESP)

5. Assistant Professor in Santa Casa Medical School of São Paulo. Department of Internal Medicine

6. Associate professor, Department of Psychiatry, Universidade Federal de São Paulo (UNIFESP)

Work was developed: Irmandade da Santa Casa de Misericórdia de São Paulo (ISCMSP) – Emergency Service, Department of Medicine

Address for correspondence: Aida Cristina Suozzo. Rua Antonio Júlio dos Santos, 554 Apto: 43, 05661-020 São Paulo – SP; Brazil. Tel: + 55 113749-1721. E-mail: aidacristinasuozzo@terra.com.br

This research received no financial aid.

No of conflict of interest

Introduction

Cardiovascular risks associated with night shift work among medical staff have been suspected for several years⁽¹⁾. Adams et al detected higher blood pressure (BP) among physicians during emergency night shifts⁽²⁾. On-call duty for physicians involves increased workload, disturbed sleep with consequently alterations of circadian rhythm and hormonal changes⁽³⁾.

Although studies have demonstrated the correlation between work and higher blood pressure, there is scarce information on behavioral of blood pressure of Brazilian residents during day-by-day training⁽⁴⁾. The aim of our study was to evaluate the effects of 24-hour working day with a 12 hours night shift in emergency room (ER) on BP and compare this with a regular working day without a night shift, among a group of first year Internal Medicine residents.

Methods and Materials

A cross-sectional study was conducted between February 2005 and January 2006 at ER of a tertiary hospital. After the approval of the ethics committee (n° 074/04), we invited all (n=40) medical residents at first year of training at the Department of Internal Medicine at Irmandade da Santa Casa de Misericórdia de São Paulo (ISCMSP - private, charity and education hospital) in São Paulo, Brazil. Thirty-eight out of the forty first-year internal medicine residents agreed to participate and signed the informed consent.

We included residents during a journey of stage of internal medicine ward and had not been a night on-call for at least 72h before. Residents with a history of hypertension, cardiovascular and renal diseases, chronic drug use or pregnancy were excluded from the study.

The daily clinical routine of residents normally begins 7:30 until 5 p.m. and it may extended until 7:30 p.m., Monday through Friday; focusing on patient care in wards and outpatient in ambulatory medicine as well as seminars with night on-call every seventy night on average, i.e., residents have usually 1 overnight call per week in ER.

ABPM (Ambulatory Blood Pressure Monitoring over 24 hours) was performed on each resident twice: (1) first evaluation (stage 1), on a regular routine workday from 7:30 a.m. to 7:30 p.m. followed by nighttime on-call duty in an emergency room from 7:31 p.m. until 7:30 a.m. the next morning; and (2) second evaluation (stage 2), on a regular routine workday from 7:30 a.m. to 7:30 p.m., followed by nighttime off duty from 7:31 p.m. until 7:30 a.m. the next morning. The evaluation order was performed through drawing and the residents had been identified by numbers.

ABPM was recorded using an oscillometric device (*SpaceLabs, 90207; SpaceLabs Inc., Redmond, WA, USA*). For the analysis, we took the daytime monitoring to be from 7:30 a.m. to 7:30 p.m., with consecutive measurements every 15 min, while nighttime BP was measured from 7:31 p.m. to 7:30 a.m. every 20 min. Daytime and nighttime ABPM were arbitrarily defined. For the ABPM to be considered satisfactory, at least 80% of readings over the period (i.e. 22 hours) needed to be valid, with no more than two hours of interruptions. The mean BP was taken to be $\leq 140/90$ mmHg during the daytime and $\leq 125/80$ mmHg during the nighttime, as stated in the guidelines published by the Brazilian Society of Cardiology, Nephrology and Hypertension, in 2001.⁵

Data analysis was performed using SPSS version 14 (SPSS, Chicago, IL). Comparisons between stages were performed using the *paired t-test* or *McNemar test* for numerical or categorical variables, respectively. Differences were considered statistically significant when $P < 0.05$.

Results

Of the 37 internal medicine residents, 21 (55.3%) were male. The mean age was 25.4 years (\pm SD 1.4). One resident was excluded because of hypertension (using atenolol).

The first two columns of Table 1 show higher means systolic and diastolic BP during the daytime and nighttime in Stage 1. Next column (third) we found significant differences of systolic and diastolic BP between two stages in daytime and in nighttime period. But when we compared the BP between periods of each stage, only significant difference was detected in Stage 2 (column 4 of table 1).

Table 2 shows the behavior of the nocturnal BP fall among the residents. In Stage 1, with nighttime on-call duty, 28 (76%) residents did not present nocturnal fall and in Stage 2, while resting at home, 13 (35%). Thus, 12 of the 37 residents did not present nocturnal fall in both stage, and 20 (54%) presented a nocturnal fall in Stage 2 although they had not presented a fall in Stage 1, during nighttime on-call duty. It was found that nighttime on-call duty modified the occurrence of nocturnal falls (*McNemar Test*; $p = 0.004$).

Discussion

This study evaluated the behavior of BP over a 24-hour period that included nighttime on-call duty, in comparison with a regular workday, among young Brazilian physicians undergoing training. Our findin-

Table 1

Mean (±SD) BP readings from ABPM (mmHg) during daytime and nighttime periods of Stage 1 and Stage 2

Blood pressure	Period	Time		p ¹
		Stage 1	Stage 2	
Diastolic (mm Hg)	Daytime	75 (±7)	71 (±7)	0.01
	Nighttime	74 (±8)	64 (±5)	0.00
	p ²	0.76	0.00	
Systolic (mm Hg)	Daytime	118 (±8)	115 (±9)	0.01
	Nighttime	116 (±10)	108 (±8)	0.00
	p ²	0.09	0.00	
Mean (mm Hg)	Daytime	89 (±7)	87 (±6)	0.01
	Nighttime	89 (±7)	80 (±6)	0.00
	p ²	0.80	0.00	

The values listed are means; P¹ - p-values for the comparison of mean BP between Stage 1 and Stage 2; P² - p-values for the comparison of mean BP between daytime and nighttime periods; SD: standard deviation; p<0.05 was considered significant for all variables; n=37.

Table 2

Distribution of the nocturnal fall in BP that occurred in Stage 1 and Stage 2

Nocturnal Fall Stage 1	Nocturnal Fall Stage 2		Total
	No	Yes	
No	8 (22%)	20 (54%)	28 (76%)
Yes	5 (13%)	4 (11%)	9 (24%)
Total	13 (35%)	24 (65%)	37 (100%)

Data are for total number of residents (n= 37); p = 0.04.

gs indicated that significant effects on BP occurred during the nighttime. Firstly, the systolic and diastolic BP was significantly higher during the daytime and nighttime in Stage 1. Secondly, only in Stage 2 we found difference between daytime and nighttime in both BP. 76% of the residents did not presented nocturnal BP fall when they were on-call duty.

Our results are in agreement with other studies in certain aspects, such as the abnormally high mean BP readings during the 24-hour shiftwork^(2,4). A European study reported the effects of 24-hour on-call duty on blood pressure and on neuroendocrine and inflammatory responses among 30 healthy middle-aged physicians. Their results revealed higher 24-hour diastolic BP, along with higher diastolic BP during the nighttime and a higher rate of systolic BP greater than 125 mmHg during sleeping time (mean of sleep 315 min) while on duty⁽⁶⁾. A Brazilian study with 61 residents also detected higher mean BP during sleeping time (mean of sleep 252.4 min) within 24-hour on-call duty than during sleeping time within the normal working day (mean of 433.9 min)⁽⁴⁾.

Nevertheless, some important issues need to be highlighted. In our study, twenty-eight residents (76%) did not present nocturnal fall when they were on call, thus contrasting with results of Fialho et al⁽⁴⁾ and Rauchenzauner et al⁽⁶⁾. However, differences in study design, medical specialty and methods for evaluate the blood pressure have limited to compare studies. The work characteristics, environmental burden and lack of homogeneity between the study groups may also have influenced the differences in the results.

In spite of these criticisms, we recognize that it is difficult to design a study to evaluate the blood pressure in physicians, especially during a night on call. Therefore, we designed a study that combined several features. Importantly, we sampled a homogeneous group of doctors. The subjects were relatively young, without previous work experience and were their own controls (Stage 2). In addition, residents were subjected to the same workload in the internal medicine ward with the same number of working hours per week including night shifts. The residents were all exposed to the same environmental burden in the ER, which is a highly stressful emergency sector with few opportunities to rest.

Thus, our results could be considered a realistic model of a night on call day in the first-year of internal medicine residency at a Brazilian teaching hospital mainly because we do not consider the sleeping on call as a period of adequate sleep like in others studies^(2,4,6). So, the elevation of BP during nights shift works and absent of nocturnal fall in young doctors need more investigations, even though in older physicians and these data can be used in strategies for early intervention on risk factors.

Conclusions

In conclusion, this study of medical residents in their first year of training showed that BP was higher during 24-hour working days with nights spent on call, particularly during the nighttime.

Limitations

The results from this study should be read in context, given that they came from a single institution and relate to medical residents within a single medical specialty.

Acknowledgments

The authors thank all of the internal medicine residents for their participation in this study, as well as Jaiza Gomes Nogueira, Silvânia Experdião Silva Santos, Suzete Silva Santos for performing the MAPA appliances and Zelinda Franzini - secretary of Unit of Heart and Lung.

References

1. Steptoe A. Night shift work and cardiovascular health of medical staff. *Eur Heart J*. 2009; 30:2560-1.
2. Adams SL, Roxe DM, Weiss J, Zhang F, Rosenthal JE. Ambulatory Blood Pressure and Holter Monitoring of Emergency Physicians before, during, and after a night shift. *Acad Emerg Med*. 1998; 5:871-7.
3. Smith AM, Morris P, Rowel KO, Jones TH, Channer KS. Junior doctors and the full shift rota – psychological and hormonal changes: a comparative cross-sectional study. *Clin Med*. 2006; 6:174-7.
4. Fialho G, Cavichio L, Povoia R, Pimenta J. Effects of 24- h shift work in the Emergency room on ambulatory blood pressure monitoring values of medical residents. *Am J Hypertens*. 2006; 19:1005-9.
5. Sociedade Brasileira de Hipertensão, Sociedade Brasileira de Cardiologia, Sociedade Brasileira de Nefrologia. III Diretrizes para Uso da Monitorização Ambulatorial da Pressão Arterial. *Rev Bras Hipertens*. 2001; 4:6-22.
6. Rauchenzauner M, Ernst F, Hintringer F, Ulmer H, Ebenbichler CF, Kasseroler MT, et al. Arrhythmias and increased neuro-endocrine stress response during physicians' night shifts: a randomized cross-over trial. *Eur Heart J*. 2009; 30:2606-13.

Trabalho recebido: 07/12/2012

Trabalho aprovado: 21/12/2012