AMBULATORY BLOOD PRESSURE MONITORING IN HEALTH WORKERS DURING NIGHT SHIFT DUTY

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ABSTRACT

BACKGROUND
BP and heart rate fluctuate over a 24 hours period. External stresses and subject’s activities have direct effects on BP and heart rate. BP and heart rate also vary according to their own circadian rhythm. Stress can cause hypertension through repeated elevations of BP.

METHODS
This is a cross-sectional study conducted in Regional Institute of Medical Sciences (RIMS) Hospital amongst Health Workers.

RESULTS
Most of the Health Workers are Males (63%) and in the age group of 21-30 years with mean age of 30.22±6.32. Both systolic and diastolic hypertension was found during day, night and over 24 hours duty. Systolic hypertension during day duty was 10% which increases to 39% during night time duty. Systolic and diastolic hypertension during the 24 hours duty was found to be 22% and 39% respectively. DBP hypertension during day time duty was found to be 26% which increases to 48% during night time duty. The overall hypertensive distribution of hypertension of health workers is 29%, 52% and 42% during day time, night time and 24 hours duty respectively.

CONCLUSIONS
During Night time duty, more Health Workers were hypertensive (52%) as compared to day time duty which was lesser (29%) and over the 24 hours duty 42% of Health workers were hypertensive. Thus, the present findings suggest effects of occupational stress on ABP measured at work, in night shift and over 24 hours period among health workers. In the long run, stressful night duty increases the risk of development of hypertension.


BACKGROUND
BP and heart rate fluctuate over a 24 hours period and are regulated by complex internal physiological mechanisms. External stress and activities have direct effects on BP and heart rate. Day time and night time may attempt to synchronise BP to their own circadian rhythm. Stress can cause hypertension through repeated BP elevations. Factors affecting BP through stress include white coat hypertension, job strain, race, social environment, and emotional distress. Furthermore, when one risk factor is coupled with other stress producing factors, the effect on BP is multiplied. Several studies show that stress does not directly cause hypertension, but can lead to repeated BP elevations, which eventually may lead to hypertension.

Financial or Other, Competing Interest: None.
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Inclusion Criteria
- Doctors, nurses and paramedical staffs on emergency night shift duty willing to participate in the study.
- BP at clinic evaluation <140/90 mmHg on at least two occasions (previously normotensive adults).
- Age >18 years.

Exclusion Criteria
- Hypertension.
- Pregnant or lactating women.
- History of congenital heart disease.
- Persons taking anti-hypertensive medication for indications other than hypertension (alpha blocker for prostatic enlargement, Angiotensin converting enzyme inhibitor for Congestive Heart Failure).
- Substance abuse (cigarette, alcohol), psychiatric drug or other medications that can affect BP.
- Unwilling participants.

With the participant consent, BP was measured twice using mercury BP machine in order to rule out hypertension and to have a baseline reading. After which ambulatory blood pressure (ABP) device was connected to the participant and ABP was recorded from the non-dominant upper limb from 1:00 pm to 1:00 pm the next day.

Recording was taken at intervals of at least one hour during day time and at intervals of at least two hours at night time. Blood pressure recorded after 6:00 pm to 6:00 am the next morning was considered night time and the rest was considered day time recording. The mean value for systolic and diastolic blood pressure was then calculated for night, day and 24 hours’ time period.

The person’s status was classified as hypertensive if at least one of the criteria based on 24-hour BP monitoring is satisfied.

Ethical Approval
Prior permission was taken from the Institutional Research Ethics Board, RIMS, Imphal before the study was conducted. Informed consent of the participants of the study was taken as per research ethics board guidelines.

Statistical Analysis
The data collected was checked for consistency and completeness. The data was analysed using statistical package for social sciences (SPSS version for Windows statistical computer software version SPSS 21). Descriptive statistics like mean, standard deviation and percentages was used. ANOVA and T-test was used to see the association between change in BP and selected variables. P value < 0.05 was taken as significant.

RESULTS
Ambulatory BP monitoring was done on 100 health workers comprising doctors, nurses and others (paramedical staffs), working in different departments. The results were tabulated and statistically evaluated using proper methods.
Majority of the Health Workers studied were Hindu (61%). Christian and Muslim accounts 30% and 3% respectively and as shown in the table and figure.

Table 5. BMI (kg/m\(^2\)) Distribution of Health Workers Studied

<table>
<thead>
<tr>
<th>BMI (kg/m(^2))</th>
<th>No. of Health Workers</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>80</td>
<td>80.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>17</td>
<td>17.0</td>
</tr>
<tr>
<td>Obese</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100.0</td>
</tr>
</tbody>
</table>

During day time duty 90% of the health workers had normal SBP where as 10% were found to be hypertensive in SBP but during night time duty the number of normal SBP pressure decreases to 61% and the number of hypertensive SBP increases to 39%. And in the whole 24 hours duty BP monitoring it was found that 78% of the health workers had normal SBP and 22% were found to be hypertensive in SBP.
Table 7. Hypertension (Diastolic) Distribution of Health Workers Studied

<table>
<thead>
<tr>
<th>Hypertension (Diastolic)</th>
<th>No. of Health Workers (n=100)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day Time Duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>74</td>
<td>74.0</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>26</td>
<td>26.0</td>
</tr>
<tr>
<td>Night Time Duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>52</td>
<td>52.0</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>48</td>
<td>48.0</td>
</tr>
<tr>
<td>24 hrs. Duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>61</td>
<td>61.0</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>39</td>
<td>39.0</td>
</tr>
</tbody>
</table>

Table 8. Hypertension (Systolic and Diastolic) Distribution of Health Workers Studied

<table>
<thead>
<tr>
<th>Hypertension</th>
<th>No. of Health Workers (n=100)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day Time Duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>71</td>
<td>71.0</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>29</td>
<td>29.0</td>
</tr>
<tr>
<td>Night Time Duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>48</td>
<td>48.0</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>52</td>
<td>52.0</td>
</tr>
<tr>
<td>24 hrs. Duty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>58</td>
<td>58.0</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>42</td>
<td>42.0</td>
</tr>
</tbody>
</table>

During day time duty 74% of the health workers had normal DBP where as 26% were found to be hypertensive in DBP but during night time duty the number of hypertensive DBP increases to 48%. And, during 24 hours duty BP monitoring it was found that 39% of the health workers were found to be hypertensive in DBP.

Out of the 100 health workers, during day time duty 29% were found to be hypertensive which increases to 52% during night time emergency duty which may account to more stress and improper sleep while doing emergency duties at night. And during 24 hours duty BP monitoring it was found that 42% of the health workers were found to be hypertensive.
The table above shows the mean SBP of day, night and 24 hours. The association was not found to be statistically significant.

Table 10 shows the association between mean SBP at 41-50 years. The association was found to be statistically significant.

Table 11 shows the association between mean SBP of day, night and 24 hours. The association was not found to be statistically significant.

Table 12 shows the association between mean SBP of day, night and 24 hours. The association was not found to be statistically significant.

Table 13 shows the association between mean SBP of day, night and 24 hours. The association was not found to be statistically significant.

Table 14 shows the association between mean SBP of day, night and 24 hours. The association was not found to be statistically significant.

Table 15 shows the association between mean SBP of day, night and 24 hours. The association was not found to be statistically significant.

Table 16 shows the association between mean SBP of day, night and 24 hours. The association was not found to be statistically significant.

**DISCUSSION**

This study included 69% males and 37% females comprising 63% doctors, 20% nurses, and other included technicians, attendants, etc. This is comparable with study conducted by O’Connor et al. which included laboratory technicians, nurses, attendants, etc. The association was not found to be statistically significant.

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30.22±6.32 as mean. This was comparable with the study conducted by Light KC et al in which out of the 129 working men and women the age group was in the range of 18 to 47 years and mean ages were 32.9 and 31.3 years for men and women respectively.

Hypertension is more prevalent among night shift compared with day shift workers. This finding indicated that more than one fourth (29%) of the participants had high BP during day which increased to almost half at night time (48%). This result is consistent with study done by Chau NP et al1 in 24 hours ABP in shift worker in France. Similar finding was also reported by Su T et al8 which showed that 12 hours night shift duty gave a persistently elevated systolic and diastolic blood pressure compared to 12 hours day shift duty. This may be accounted for more stress which can be psychological as well as physical when doing emergency duties at night due to sleep deprivation, fatigue, pressure and continuous mobility. Epidemiological studies have shown the profound influence of stress on cardiovascular mortality and morbidity as well as on ABP. As the setting was a training medical college, the stress was anticipated because most of the participants were junior doctors who were more prone to develop the stress. Acute sleep deprivation is associated with an increased sympathetic activity and decreased parasympathetic modulation. In addition, sleep disturbance may also result in sympathovagal imbalance.

Our study also found that though both systolic and diastolic blood pressure was raised during day, night and over 24 hours duty, the increase in measured DBP during day, night and 24 hours duty (26%, 48%, 39% hypertensive respectively) are more as compared to increase in SBP during day, night and 24 hours duty (10%, 39%, 22% hypertensive respectively). This is consistent with the study reported by Ogawa Y et al10 which showed that the DBP was significantly higher after total sleep deprivation. Theorrel T et al11 also found that job strain was significantly associated with DBP at night and during work.

The study found out that mean SBP measured in 24 hours was more in the older age group 41-50 years (126.44 ± 10.22; p value 0.098) but do not have any significant difference. The mean DBP during day duty (82.69±8.96; P value 0.02), night duty (78.58±10.61; P value 0.013) and 24 hours duty (81.31±9.26; P value 0.014) was found more in the age group 31-40 years and it was statistically significant which is opposite to the study done by Kario K et al12 where there was increase in SBP than DBP.

Male in 24 hours duty had more mean SBP (123.03±8.88; P value 0.022) as well as mean DBP (79.63±7.13; P value <0.001) in comparison to female mean SBP (118.49±10.35) and mean DBP (74.03±7.95) and this was consistent with study done by O’Connor DB et al on British general practitioners. The significance of the relationship and stressful condition at night is not clear cut. There is still a debate about whether a job strain can induce transient or sustained hypertension. Some author still argues that stress at work can increase BP during working hours only and that it does not predicts BP level in the long run.

As seen from many studies, obesity was a risk factor for hypertension and many chronic diseases. In this study as well, BMI >30 kg/m² has more SBP (132.67 ± 15.95; p value 0.004) and DBP (89.33 ± 14.74; p value 0.001) in 24 hours duty and this finding was statistically significant when compared to BMI <25 kg/m² and 25-30 kg/m². But mean SBP and DBP are more during day duty for all the groups. This result was consistent with the study conducted by Gaudemaris R et al13 in France among nurses and nursing assistants. The strength of this study can be attributed to the BP measured with validated automatic device and adequate sample size.

CONCLUSIONS
The development of non-invasive ABP monitoring devices has been a great impetus to clinical hypertension research, and ABP monitoring is now widely used in clinical practice. Hypertension is commonly associated with occupations which involve regular long period of stressful night shift duty. The present study was conducted among the hospital staff during night shift to monitor the diastolic and systolic blood pressure for day, night and 24 hours duty. During day time duty out of 100 health workers studied, about 10% satisfied the criteria for systolic hypertension based on 24-hour BP monitoring and so they were classified as hypertensive. Likewise, 39% of health workers were found to be systolic hypertensive during night time duty which was increased as compared to day time duty. Similarly, the same result was seen in DBP in which 26% and 48% health workers were found to be diastolic hypertensive during day time and night time duty respectively. The result was significant in DBP as compared to SBP.

Therefore, in the study, during night time duty, more health workers were hypertensive (52%) as compared to day time duty which was lesser (29%) and over the 24 hours duty, 42% of health workers were hypertensive. Thus, the present findings provide indicate that occupational stress has an effect on ABP measured at work, in night shift and over 24 hours period among health workers, and in the long run, stressful night duty increases the risk of development of hypertension.

Acknowledgement
We want to acknowledge all the staff of the Institute who helped us during the study period.

REFERENCES


