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Ambulatory Blood Pressure Monitoring in Pregnancy: A Prospective Study

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Abstract

Introduction: The use of Ambulatory blood pressure monitoring may help in accurate assessment of blood pressure patterns throughout pregnancy and early detection of pre eclampsia. *Objective:* To determine whether Ambulatory BP monitoring is comparable to conventional BP measurements in pregnancy. *Methods:* A prospective study was conducted in Department of OBG at JSS Hospital from July 2016-June 2017. 40 women, 18–35 years of age with no risk factors like multiple pregnancy, molar pregnancy, chronic hypertension, renal, cardiac, connective tissue disorders, diabetes and thyroid disorders were recruited. Office BP monitoring and 24 hour Ambulatory BP measurement using Welch Allyn 6100P Ambulatory BP monitor was done. The BP was recorded at 8–14 weeks, 16–20 weeks, 22–28 weeks and 32–36 weeks. *Results:* The SPSS 21 software was used for statistical analysis. The mean ambulatory systolic and diastolic pressures did not show significant difference when compared to office BP. The night time ambulatory pressures when compared to office recordings also did not show significant changes. There was no night time dip in BP in majority of women. *Conclusion:* Ambulatory BP monitoring is an effective method, which may be used in high risk women, for early detection of hypertensive disorders in pregnancy.

Keywords: Ambulatory BP monitoring; Systolic blood pressure; Diastolic blood pressure; Mean arterial pressure; Pregnancy.

Introduction

Conventionally, blood pressure monitoring in pregnant women has relied mostly on few measurements in the physician's office. Such single measurements may be misleading because BP and heart rate vary according to various rhythms, and measurements may be influenced by external and internal stimuli, according to the patients sleeping or waking schedule, physical activity, diet, and emotional state. Both Systolic BP (SBP) and Diastolic BP (DBP) vary in adulthood on an average > 50 mm Hg within each day [1,2]. The use of noninvasive Ambulatory blood pressure monitoring has provided a method of BP assessment that may compensate for some of the limitations of casual measurements. Ambulatory BP monitoring has the added advantage that in addition to the immediate presentation of absolute BP values, it gives the extra dimension of facilitating analysis of the circadian variation of BP in pregnancy [3,4]. Ambulatory monitoring helps to assess blood pressure

patterns in a more accurate way and allows for precise description of the variation in blood pressure throughout pregnancy. Also, diurnal variations of blood pressure and its association with pre eclampsia can be documented.

Aims and Objectives

1. To determine whether Ambulatory BP monitoring is superior to conventional BP measurements for the detection of gestational hypertension/pre eclampsia, and whether it can reduce the number of hospital admissions for patients with suspected pre eclampsia.
2. To determine if there is a change in the circadian rhythm of systolic and diastolic pressure in pregnancies subsequently complicated by hypertension.

Materials and methods

A prospective randomized study was conducted in Department of Obstetrics and Gynecology at JSS Hospital over a period of one year from July 2016 to June 2017. 40 women were recruited who were between 18 and 35 years of age and attended the antenatal clinic from the first trimester onwards. They underwent both conventional Blood pressure monitoring and Ambulatory BP monitoring at various intervals as described below.

A team comprising of a consultant obstetrician and a resident in Obstetrics & Gynecology was in charge of data collection and analysis. Both of them were trained to record the blood pressure in the correct way as described below; and their observations monitored for intra observer and inter observer bias. The BP was measured according to a strict protocol. The woman was seated in a quiet room with her right arm supported and the correct-sized cuff sited at the level of the heart. The first and fifth Korotkoff sounds were taken for systolic and diastolic BP respectively and a total of three readings taken over a minimum of five minutes. The recorded blood pressure was the average of the three readings. The Diamond mercury sphygmomanometer was used for office BP monitoring. The device was regularly calibrated and its accuracy checked. This was repeated at regular intervals; with the same instrument. The frequency of monitoring was as follows:

i: At 8 – 14 weeks

ii: At 16 – 20 weeks

iii: At 22 – 28 weeks

iv: At 32 – 36 weeks

Ambulatory BP monitoring was done in all women, at the same intervals, for 24 hours, from 10 am to 10 am on the next day, at hourly intervals both at day and night, in addition to office bp monitoring. The Welch Allyn 6100P Ambulatory blood pressure monitor was used. All monitors were serviced regularly and checked for accuracy at the beginning of the trial. The correct size of BP cuff was applied to the patient's non-dominant arm by the trained resident. The mean of the recorded readings was taken into consideration. These measurements were in addition to the regular antenatal monitoring that the patient underwent.

Exclusion criteria: Patients with the following problems were excluded from the study:

Age <18 or >35 years

Multiple pregnancy

Molar pregnancy

Chronic hypertension; primary or secondary

Renal, cardiac and connective tissue disorders

Pre existing diabetes mellitus

Hyperthyroidism

Results

Statistical analysis: The statistical analysis was done using ANOVA and paired "t" test.

The majority of our women (47.5%) were in the age group of 21 to 25 years. 7.5% were more than 31 years of age, and 17.5% were less than 20 years of age.

Figures 1–3 show the mean differences between office blood pressure and ambulatory blood pressure at each visit. The systolic, diastolic and mean arterial pressures are separately compared. Also we have separately compared the office blood pressure recordings with the day time and nocturnal (sleep) ambulatory BP recordings. Although diastolic pressures show maximum variation, none of them reach statistical significance ($p<0.001$).

Table 1 shows the diurnal variation of blood pressure as recorded by ambulatory monitoring. The mean difference in systolic pressures ranged from 6.2 mm Hg to 8.1 mm Hg. Although this shows a statistically significant fall in night time systolic blood pressure, these women cannot be all said to be "dippers." As per the definition the 10 – 20% nocturnal dip in systolic pressure was seen

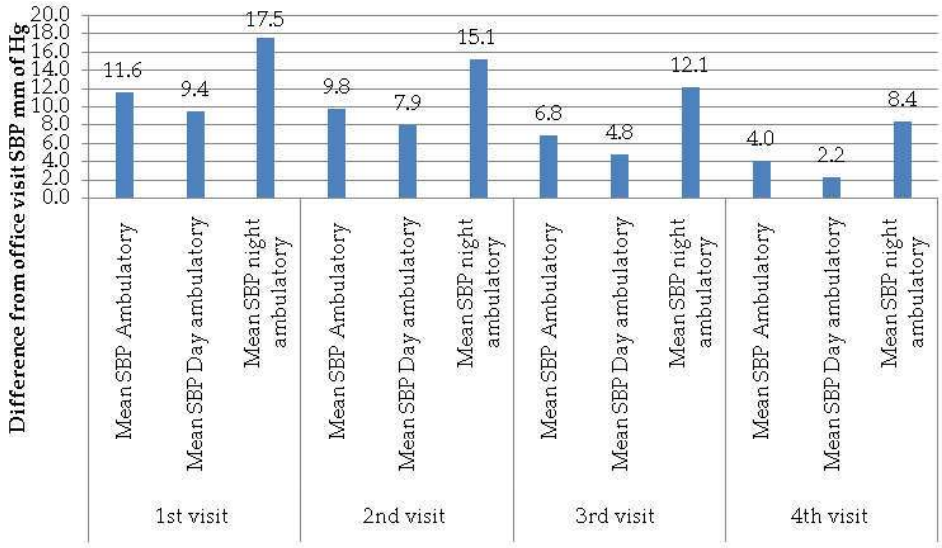

Fig 1: Comparison of Mean differences of Systolic Ambulatory BP with Systolic Office BP

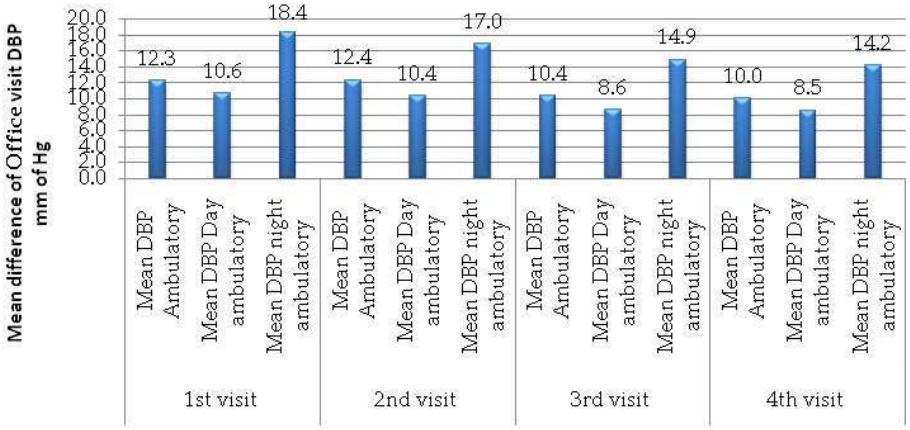

Fig 2: Comparison of Mean differences of Diastolic Ambulatory BP with Diastolic Office BP

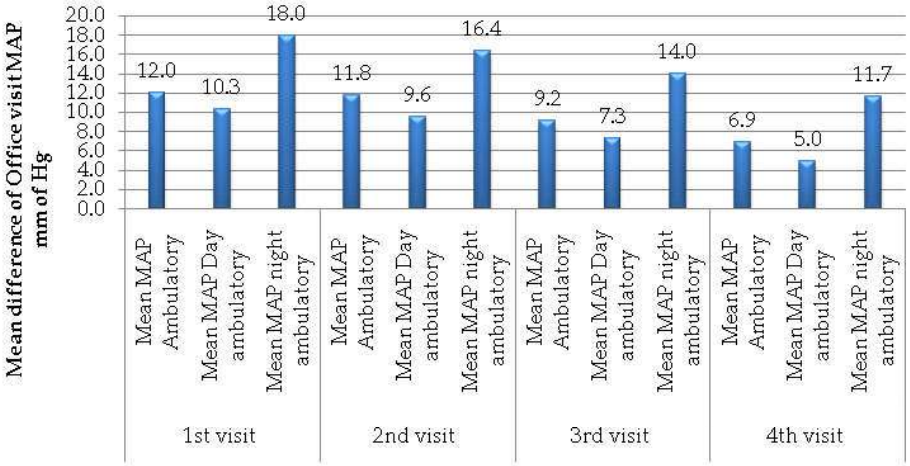

Fig 3: Comparison of Mean differences of MAP of Ambulatory BP with MAP of Office BP

Table 1: Diurnal variation of Blood Pressure.

	Mean	N	Std. Deviation	Mean difference	SD of difference	p
Mean_SBP_da1	99.800	40	7.6097	8.1000	6.3237	<0.0001
Mean_SBP_na1	91.700	40	7.6097			
Mean_DBP_na1	52.250	40	6.1634			
MAP_da1	73.179	40	6.4692	7.6495	5.6382	<0.0001
MAP_na1	65.530	40	6.5293			
Mean_SBP_da2	102.150	40	9.5288	7.2750	5.1390	<0.0001
Mean_SBP_na2	94.875	40	10.7302			
Mean_DBP_da2	59.875	40	6.6917	6.5500	4.1876	<0.0001
Mean_DBP_na2	53.325	40	7.5732			
MAP_da2	73.964	40	7.3578	6.7922	4.3659	<0.0001
MAP_na2	67.171	40	8.4545			
Mean_SBP_da3	108.900	40	9.8834	7.3000	6.5052	<0.0001
Mean_SBP_na3	101.600	40	11.4283			
Mean_DBP_da3	63.400	40	7.5644	6.3500	7.0148	<0.0001
Mean_DBP_na3	57.050	40	8.9068			
MAP_da3	78.563	40	7.9585	6.6680	6.6524	<0.0001
MAP_na3	71.895	40	9.4609			
Mean_SBP_da4	111.300	40	12.2038	6.2750	7.2994	<0.0001
Mean_SBP_na4	105.025	40	14.6978			
Mean_DBP_da4	64.800	40	7.1439	5.7000	5.4828	<0.0001
Mean_DBP_na4	59.100	40	8.9064			
MAP_da4	80.630	40	8.5443	6.6500	7.1617	<0.0001
MAP_na4	73.980	40	1 the night time systolic and diastolic pressurn 0.6257			

in only 7.5% of women throughout the four visits. However, these women without the nocturnal dip in systolic pressure did not develop pre eclampsia.

Similarly, the mean differences between day time and night time diastolic pressures ranged from 5.7 mm Hg to 7.7 mm Hg with a 95% confidence interval. The mean differences in the mean arterial pressures varied from 6.6 mm Hg to 7.6 mm Hg.

Discussion

Various trials have been conducted over the past twenty odd years studying the use of ambulatory blood pressure monitoring in pregnancy. Ambulatory BP monitoring has several advantages over conventional office monitoring, especially in patients with white coat hypertension and masked hypertension [5,6]. Target values for ambulatory BP in low risk hypertensive patients are 130/80 mm Hg for 24-hour BP, 135/85 mm Hg for the awake BP, and 125/75 mm Hg for the sleep BP, equivalent to office BP of ≤ 140/90 [7]. Hermida et al. conducted a prospective interventional study in 2001 on 328 women, wherein Ambulatory BP monitoring was done every 4 weeks staring from the first trimester. The SpaceLabs 90207 ABPM was used. They concluded that Blood pressure load (percentage of values above a given reference limit) is a good predictor of hypertension in pregnancy [8]. The monitor used in our study was the Welch Allyn 6100P Ambulatory blood pressure monitor. Although not specifically recommended for use in pregnancy, we found the measurements corresponding to the office recordings, thus suggesting it could be reliably used in pregnancy. The mean ambulatory values in our study were less than the corresponding office values, although the mean differences were not statistically significant. Ambulatory BP monitoring is especially useful when nocturnal hypertension or non dipping profiles are suspected. Ambulatory monitoring studies should be performed on during the normal working schedule of the woman. During the daytime we advise the women not to sleep, or do strenuous exercise. Also long periods of driving should be avoided. Women can be asked to maintain a log of their activity, time of sleep and awakening, as well as time of anti hypertensive drugs [9]. Although a detailed diary was not maintained by our women, times of sleep and wakefulness were documented during each measurement.

We studied the circadian variation of both systolic and diastolic pressures and found that there was a statistically significant fall in both systolic and diastolic pressures. Although the fall in systolic pressure was statistically significant, 92.5% of the women were classified as "non dippers." None of these women developed gestational hypertension/ pre eclampsia.

Taylor et al.; in a similar setting recorded ambulatory blood pressure values of 102 normotensive pregnant women, and concluded that "non-dipping" is common and inconsistent in normal pregnancies is unlikely to be a useful predictor of pre- eclampsia [10].

In our study, there was a steady rise in the mean systolic day time pressures from the first trimester onwards. The diastolic pressures showed an insignificant fall in the second trimester and then showed a rise again, approaching first trimester values. The night time systolic and diastolic pressures showed a small rise from first trimester onwards. Ramon et al. [11] determined that circadian amplitude of BP is statistically higher during the first and second trimester, especially for the women who developed preeclampsia. They also determined that in complicated pregnancies; the circadian amplitude of BP decreases from the second to the third trimester. This is mainly due to the reduced drop in BP by night with advancing gestational age in the patients who developed preeclampsia. Results from this prospective study on pregnant women systematically sampled by ABPM along gestation corroborate earlier conclusions indicating that diagnosis of hypertensive complications in pregnancy cannot rely on casual BP measurements obtained at the physician's office.

The National BP Advisory Committee of the National Heart Foundation of Australia states that Ambulatory BP monitoring has a role in assessing hypertension in pregnancy. Definitive outcome studies are needed in the form of randomized controlled trials comparing management of hypertension based on office BP measurement vs ABPM [12].

Conclusion

Ambulatory BP monitoring may lead to reappraisal of clinical management of hypertension in pregnancy. It may reduce the number of antenatal admissions and help to provide direct clinical action to high-risk patients. The diagnosis of white coat hypertension will also be much easier with ambulatory monitoring. It will thereby reduce costs associated with hospital admissions for management of hypertension in pregnancy, as well as increase patient satisfaction as an efficient tool for out patient monitoring.

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