

Blood Pressure Measurement for Hypertension in Pregnancy

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Abstract

Objective: Ambulatory BP monitoring (ABPM) has been proposed as a logical approach to overcoming many of the problems associated with clinical BP measurement. The extent of its use in diagnosing hypertension in pregnancy is unknown. The objective of this study was to identify the practices surrounding use of ABPM by practitioners to diagnose hypertension (HTN) and white coat hypertension (WCH) in pregnant women.

Methods: We mailed questionnaires to all obstetricians and family doctors practising obstetrics who were listed in the online medical directory of the College of Physicians and Surgeons of Alberta. Data were analyzed using SPSS.

Results: Completed questionnaires were received from 81 obstetricians and 86 primary care physicians who manage hypertension in pregnancy. The majority of obstetricians (83%) and primary care physicians (79%) indicated that they "almost always" or "often" attempt to differentiate WCH from true HTN in pregnancy. The most popular method identified to differentiate WCH from true HTN in pregnancy was self (intermittent) home BP monitoring (78% of obstetricians and 69% of primary care physicians, $P = 0.18$). A minority of physicians in each group reported using ABPM to evaluate HTN in pregnancy, with significantly fewer obstetricians using ABPM diagnostically than primary care physicians (12% vs. 26%, $P = 0.04$).

Conclusion: Obstetrical care providers in Alberta are aware that WCH is an issue among pregnant women. While ABPM is chosen in a minority of cases, both obstetricians and primary care physicians appear to have a strong preference to use self BP monitoring for further BP evaluation.

Key Words: Blood pressure monitoring, hypertension, obstetrics, family medicine, ambulatory monitoring, pregnancy

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Résumé

Objectif : Le suivi ambulatoire de la TA (SATA) a été proposé à titre d'approche logique en vue de surmonter bon nombre des problèmes qui sont associés à la mesure de la TA clinique. La portée de son utilisation dans le diagnostic de l'hypertension pendant la grossesse est inconnue. L'objectif de cette étude était d'identifier les pratiques entourant l'utilisation du SATA par les praticiens pour diagnostiquer l'hypertension (HTN) et l'hypertension réactionnelle (HR) chez les femmes enceintes.

Méthodes : Nous avons posté des questionnaires à tous les obstétriciens et à tous les médecins de famille pratiquant l'obstétrique dont le nom apparaissait dans le répertoire médical en ligne du College of Physicians and Surgeons of Alberta. Les données ont été analysées au moyen du logiciel SPSS.

Résultats : Nous avons reçu des questionnaires remplis de la part de 81 obstétriciens et de 86 médecins de premier recours qui assuraient la prise en charge de l'hypertension pendant la grossesse. La majorité des obstétriciens (83 %) et des médecins de premier recours (79 %) ont indiqué qu'ils tentaient « pratiquement toujours » ou « souvent » de distinguer l'HR de l'HTN véritable pendant la grossesse. À cette fin, la méthode la plus populaire qui a été identifiée était l'autosuiivi (intermittent) de la TA à la maison (78 % des obstétriciens et 69 % des médecins de premier recours, $P = 0,18$). Une minorité de médecins de chacun des groupes ont signalé avoir recours au SATA pour évaluer l'HTN pendant la grossesse; les obstétriciens étant considérablement moins nombreux à utiliser le SATA à des fins diagnostiques que les médecins de premier recours (12 %, par comp. avec 26 %, $P = 0,04$).

Conclusion : Les fournisseurs de soins obstétricaux d'Alberta sont conscients du problème que pose l'HR chez les femmes enceintes. Bien que le SATA soit mis en œuvre dans une minorité de cas, tant les obstétriciens que les médecins de premier recours semblent avoir une forte préférence quant à l'utilisation de l'autosuiivi de la TA pour approfondir l'évaluation de la TA.

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INTRODUCTION

Hypertension is the most common medical disorder of pregnancy, estimated to occur in 6% to 8% of all gestations.¹ In Canada and other developed nations, hypertensive disorders of pregnancy remain the second leading cause of maternal mortality, accounting for 16% of obstetrical deaths.^{2,3} The current clinical practice guidelines, outlined by the SOGC, classify the hypertensive disorders of pregnancy as either pre-existing or gestational HTN, with or without preeclampsia. Isolated office or WCH is a phenomenon that commonly occurs in pregnancy when a diagnosis of elevated BP (diastolic BP > 90 mmHg) occurs in the clinical setting but normal BP (< 135/85 mmHg) persists away from medical visits.⁴

BP measurements at scheduled antenatal visits are the mainstay for diagnosing and treating HTN in pregnancy. However, the accuracy of conventional office BP measurements has been criticized, and there is increasing evidence to suggest that continuous ABPM at home more accurately reflects a patient's true BP and variability.⁵ Since ABPM records BP outside the medical environment, it is considered the technique of choice to identify individuals with WCH.⁵

Denolle et al. conducted a study of pregnant women with recently diagnosed HTN based on three office BP readings and found that 76% of these patients had WCH when home measurements were used.⁶ Other studies have reported that 29% to 32% of women with high BP in the office had normal pressures at home.^{7,8} In one such study, ABPM predicted pregnancy outcome better than office BP measurement, and WCH was identified in 29% of women with high BP in the third trimester.⁹ That study also reported significantly higher office systolic and diastolic BP in patients with WCH compared with normotensive patients, with nearly identical 24-hour BP profiles. Women with true HTN had 24-hour BP values significantly higher than those in both the WCH and normotensive groups.⁹

Despite the wide range reported regarding the prevalence of WCH, an effort should be made to distinguish between true HTN and WCH. Patients with persistently elevated BP outside of the clinical setting are more likely to develop preeclampsia, experience longer hospital stays, deliver at an earlier gestational age, and give birth to infants with

significantly lower birth weights.¹⁰ The definitive treatment for gestational HTN is delivery of the fetus, which may not be optimal depending on gestational age. Additionally, antihypertensive therapy is not without risk, as excessive BP lowering may lead to intrauterine growth restriction and low birth weight.¹¹ Antihypertensive medications should not be prescribed for women with WCH, to avoid treating a condition that is limited to the clinical appointment and typically has a better outcome than true essential HTN.¹² Women are therefore best served by an accurate diagnosis.

An alternative to ABPM is self BP monitoring, which commonly consists of patients self-recording BP using an automated device intermittently throughout the day. Current practice guidelines recommend this method as a useful adjunct to the office clinical assessment for management of HTN outside pregnancy.¹³ Despite the growing interest in different forms of out-of-office BP assessment in the pregnant patient, a survey of Canadian practitioners found that a mercury sphygmomanometer is used to determine diastolic BP by the majority of obstetricians (79%) and family doctors (84%).¹⁴ The survey did not address the use of ABPM. While the first report of ABPM in pregnancy was published over 20 years ago by Rayburn and colleagues,¹⁵ it is not known to what extent practitioners currently use ABPM or self BP monitoring to diagnose and treat HTN or to identify WCH in pregnancy. We therefore conducted a survey of obstetricians and primary care physicians who provide prenatal care in Alberta to describe their practice regarding the assessment of BP for diagnosis, treatment, and monitoring of HTN in pregnancy, and specifically for the diagnosis of WCH.

METHODS

A questionnaire was developed for this mailed survey, based on a previous questionnaire used to enquire about the attitudes of primary care physicians to adult home BP monitoring in non-pregnant patients.¹⁶ Questions explored physicians' views about home BP monitoring in pregnancy, the frequency with which they attempt to differentiate between true HTN and WCH, and their practice with respect to prescribing ABPM or self BP monitoring for pregnant patients with high BP detected in the office. The majority of items were presented as multiple choice questions, though some were open-ended questions. The questionnaire was administered to obstetrics and gynaecology residents before disbursement, to assess content validity and to improve the questions and format. Questionnaires were mailed to all physicians in our sample. The first mailing included a cover letter, the questionnaire, and a postage paid return envelope. The same package was sent as necessary at three and six weeks after the initial mailing.

ABBREVIATIONS

| | |
|------|--------------------------------------|
| ABPM | ambulatory blood pressure monitoring |
| BP | blood pressure |
| HTN | hypertension |
| WCH | white coat hypertension |

Our sample of physicians included all obstetricians and primary care physicians who practise low-risk obstetrics in Alberta. Physicians were identified from the publicly available online medical directory of the College of Physicians and Surgeons of Alberta. Eligible survey respondents had an active obstetrical practice, as they indicated on the returned questionnaire that their practice included caring for pregnant patients with HTN at the time of the survey.

Survey responses were entered into a database, and the data were analysed using SPSS version 15.0 for Windows (SPSS, Chicago, IL). Response frequencies were summarized for each group (obstetricians versus primary care physicians). Some questions allowed for multiple responses, so that summed frequencies might have exceeded 100%. Similarly, some questions were not answered by all respondents, and denominators were not adjusted in these cases. Where open-ended questions or listed categories were used, responses were grouped and the highest frequency answers were summarized for discussion. Comparisons between groups used tests of proportions. A sample-size calculation carried out before the study estimated that a sample of 68 respondents in each group would be required to detect a difference in frequency of ABPM of 52% in primary care physicians versus 75% in obstetricians ($P = 0.05$, power 80%).

Ethics approval was obtained from the Conjoint Health Research Ethics Board for the University of Calgary and Alberta Health Services.

RESULTS

Questionnaires were mailed to a total of 347 physicians. Of those physicians, three did not practise obstetrics and six were not at the address listed. Completed questionnaires were received from 213/338 (63%). Of those, 46/213 did not diagnose or manage HTN in pregnancy, leaving a study population of 167 physicians: 81 obstetricians (49%) and 86 primary care physicians (51%).

The characteristics of the respondents and their practice types are shown in Table 1. Of the physicians surveyed, 98% of obstetricians and 90% of primary care physicians stated that they classify HTN in pregnancy using a diastolic measurement of greater than 90 mmHg. In addition, 66% of obstetricians and 58% of primary care physicians considered a systolic BP ≥ 140 mmHg important for clinical decision-making.

Regarding BP assessment in pregnant patients, similar proportions of respondents (74% of obstetricians and 70% of primary care physicians) reported using self BP monitoring to identify HTN (Table 2). A minority of physicians in each group reported using ABPM to evaluate HTN in pregnancy, with significantly fewer obstetricians than primary

care physicians (12% vs. 26%, $P = 0.04$) using ABPM diagnostically. There was no significant difference between obstetricians and primary care physicians regarding the use of self BP monitoring or ABPM in the treatment of HTN in pregnancy, and both groups were more likely to use self BP monitoring than ABPM (Table 2).

Physician recommendations for BP surveillance in a scenario describing a hypertensive pregnant patient did not differ between the surveyed groups, although obstetricians were less likely to refer a patient for expert consultation (15% vs. 45%, $P < 0.01$). Both groups were most likely to select frequent office monitoring as their preferred method for surveillance of the HTN in pregnancy, followed by self BP monitoring. Only 10% of obstetricians and 6% of primary care physicians recommended ABPM in this setting.

The majority of obstetricians (83%) and primary care physicians (79%) indicated that they “almost always” or “often” attempt to differentiate WCH from true HTN in pregnancy (Table 3). The most popular method identified to differentiate WCH from true HTN in pregnancy was self home BP monitoring (78% of obstetricians and 69% of primary care physicians, $P = 0.18$). BP measurement at a pharmacy or fire station was the second most common recommendation (30% of obstetricians and 48% of primary care physicians). A significantly lower proportion of obstetricians reported that they would use ABPM to differentiate WCH from true HTN in pregnancy (10% vs. 33%, $P < 0.01$), although this was not a preferred method for either group (Table 3). If WCH was confirmed, 82% of obstetricians and 73% of primary care physicians said that their management decisions would change prior to delivery, while 42% of obstetricians and 35% of primary care physicians stated that they would alter their management during labour (Table 3).

Open-ended questions enquired about barriers to the use of self BP monitoring or ABPM; the three most frequently cited responses are shown in Table 4.

DISCUSSION

Review of BP readings collected during scheduled antenatal visits is the standard practice for the detection of HTN in pregnancy, most commonly based on measurements using a mercury sphygmomanometer in the physician's office.¹⁴ Our study confirmed that the majority of obstetricians and primary care physicians across Alberta practise in accordance with this recommendation from the SOGC guidelines.⁴

Unfortunately, many pitfalls of conventional office BP measurement have been described. Criticisms have focused on mechanical errors, such as improper cuff size, instrument defects, lack of calibration, variation between products, and automated versus manual equipment, all of which

Table 1. Characteristics of survey respondents

| Characteristic | Obstetricians n = 81 n (%) | Primary care physicians n = 86 n (%) |
|---|----------------------------------|---|
| Sex | | |
| Male | 41 (51) | 28 (33) |
| Female | 39 (48) | 55 (64) |
| No response | 1 (1) | 3 (3) |
| Clinical practice based in private office setting | | |
| Yes | 62 (77) | 72 (84) |
| No | 17 (20) | 13 (15) |
| No response | 2 (3) | 1 (1) |
| Population of the municipality | | |
| < 100 000 | 18 (22) | 46 (53) |
| ≥ 100 000 | 63 (78) | 40 (47) |
| Estimated number of pregnant patients seen per week | | |
| < 50 | 25 (31) | 68 (79) |
| 50–99 | 43 (53) | 13 (15) |
| ≥ 100 | 13 (16) | 5 (6) |
| Estimated number of deliveries per month | | |
| < 5 | 8 (10) | 21 (24) |
| 5–9 | 3 (4) | 30 (35) |
| 10–14 | 9 (11) | 19 (22) |
| ≥ 15 | 60 (74) | 14 (16) |
| No response | 1 (1) | 2 (2) |
| Estimated number of patients diagnosed with hypertension in pregnancy per month | | |
| < 5 | 40 (49) | 78 (91) |
| 5–9 | 36 (44) | 7 (8) |
| ≥ 10 | 3 (4) | 1 (1) |
| No response | 2 (2) | 0 (0) |

can result in discrepancies in BP values.^{17,18} Observer error may also be a factor, because there is a tendency either to normalize BP or to allow insufficient time for appropriate positioning of the patient.¹⁹ BP assessment also depends on extraneous factors, such as prior food intake, caffeine use, smoking, exercise, temperature of the room, the patient's position, and time of day.^{18,20} Finally, office visits are limited by providing only a snapshot of the BP profile that varies throughout the day.

Despite these inherent deficiencies, office BP measurement continues to be the method most frequently used to diagnose and monitor HTN, perhaps due to convenience and efficiency. The majority of obstetricians (85%) and primary care physicians (87%) in our study reported that the office BP measurement is the most important BP assessment tool for surveillance of HTN in pregnancy in their practices. In addition to office measurements, self BP monitoring was also used by many obstetricians and primary care physicians in the diagnosis, treatment, and monitoring of HTN in pregnancy. ABPM was used much less frequently and, interestingly, was used less commonly by obstetricians than by primary care physicians (12% vs. 26%). This likely represents a carryover by the primary care physicians from their use of this evaluation tool in the routine care of their non-pregnant patients.¹⁶

The diagnosis of WCH in pregnancy is potentially difficult but clinically important, as the differentiation between true HTN and WCH may prevent unnecessary treatment for transiently elevated BP in the office setting. Of survey respondents, 18% reported that they were less likely to use antihypertensives in patients with WCH. This survey also suggests that detection of WCH may reduce the likelihood of early induction in these patients: 17% of survey respondents reported they are more likely to delay induction of labour in patients with known WCH. By definition, a diagnosis of WCH cannot be based on the BP measured at office visits alone. The majority of both obstetricians and primary care physicians (83% and 79%, respectively) indicated that they “almost always” or “often” attempt to differentiate WCH from true HTN in pregnancy. Both obstetricians and primary care physicians prefer to use self home BP monitoring to assist in this distinction (78% and 69%, respectively). A significantly greater proportion of primary care physicians use ABPM for this purpose.

ABPM is often proposed as a logical approach to overcoming many of the problems associated with other clinical BP measurements. There are a number of advantages to using ABPM. First, the technique provides multiple BP measurements over a 24-hour interval, compared with less frequent snapshot readings obtained by conventional office BP or self home BP monitoring.⁵ The BP profile is reflected in

Table 2. Physicians' responses about preferred methods for blood pressure assessment in pregnant patients

| | Obstetricians n = 81 n (%) | Primary care physicians n = 86 n (%) | <i>P</i> * |
|---|----------------------------------|---|------------|
| Diagnosis of hypertension in pregnancy | | | |
| Self BP monitoring | 60 (74) | 60 (70) | 0.69 |
| ABPM | 10 (12) | 22 (26) | 0.04 |
| Treatment of hypertension in pregnancy | | | |
| Self BP monitoring | 57 (70) | 64 (74) | 0.99 |
| ABPM | 10 (13) | 17 (21) | 0.38 |
| Surveillance of hypertension in pregnancy | | | |
| Frequent office monitoring | 69 (85) | 75 (87) | 0.40 |
| Self BP monitoring | 63 (78) | 64 (74) | 0.61 |
| ABPM | 8 (10) | 5 (6) | 0.33 |
| Refer the patient | 12 (15) | 39 (45) | 0.01 |
| Other (laboratories, home care, hospital admission) | 27 (33) | 20 (23) | 0.10 |

*Statistical analyses exclude missing values

greater detail by the multiple measurements, and patients usually become accustomed to the presence of the instrument.²¹ ABPM also provides a “real life” profile of BP away from the medical environment, thereby allowing identification of individuals with WCH.²¹ Despite these advantages, ABPM has not been widely adopted for use in clinical obstetric practice, at least not in Alberta.

Prior to this survey, we were not aware of the factors that would be the most common barriers to physicians' use of ambulatory or self home BP monitoring in the care of hypertensive pregnant patients. We suspected that cost, resource limitations leading to lack of availability, and the need for patient education regarding proper use of the technology would be the most significant barriers. Interestingly, both obstetricians and primary care physicians were also concerned about the validity and accuracy of the home monitoring devices, and worried that patients might become preoccupied by their BP and become anxious. Primary care physicians were also concerned that patients might misreport their BP results, while some obstetricians noted the lack of protocols to guide home measurement and recording. An additional clinical factor is that ABPM provides a detailed evaluation of a 24-hour interval, but it is not designed to provide serial data over the days or weeks that a hypertensive disorder of pregnancy may evolve. Since automated BP machines of reasonable quality have become

affordable and widely available, self-monitoring of maternal BP with automated home BP devices has become a more popular option with physicians and patients.

To date no trials have been published assessing the impact ABPM might have on maternal or perinatal outcomes²² relative to standard care with medical decisions based predominantly on office BP. The possible risks and advantages of ABPM during pregnancy have not been evaluated.²³ As discussed above, the high cost of ABPM, the lack of its prompt availability, and uncertainty regarding its usefulness have resulted in more limited use of this methodology than of self BP monitoring. In contrast to ABPM, self BP monitoring is widely available, reasonably cheap, and comfortable, and it has previously been shown to be preferred to ABPM by pregnant women.²³ Self-monitored BP values have also not been validated regarding adverse pregnancy outcomes, but, as our study has demonstrated, physicians appear much more likely to choose this measurement technique. The SOGC guidelines state that ABPM by either 24-hour or home measurements may be useful to detect WCH.⁴ In light of the lack of evidence supporting ABPM over self home BP monitoring in pregnancy and the propensity of physicians to prefer self home BP monitoring, it is perhaps more realistic to promote self home BP monitoring as the preferred tool for the evaluation of possible

Table 3. Physicians' responses regarding the diagnosis and management of WCH in pregnancy

| | Obstetricians n = 81 n (%) | Primary care physicians n = 86 n (%) | P* |
|--|----------------------------------|---|------|
| How often physicians attempt to differentiate WCH from true HTN in pregnancy | | | 0.66 |
| Almost always | 32 (40) | 26 (30) | |
| Often | 35 (43) | 42 (49) | |
| Sometimes | 5 (6) | 8 (9) | |
| Occasionally | 5 (6) | 6 (7) | |
| Never or rarely | 2 (3) | 4 (5) | |
| No response | 2 (2) | 0 (0) | |
| Preferred methods to differentiate WCH from true HTN in pregnancy | | | |
| Self BP monitoring | 63 (78) | 59 (69) | 0.18 |
| ABPM | 8 (10) | 28 (33) | 0.01 |
| At a drug store or fire station | 24 (30) | 41 (48) | 0.02 |
| No specific interventions | 3 (4) | 4 (5) | 0.76 |
| Other | 25 (31) | 20 (23) | 0.44 |
| Influence of confirmed WCH on management decisions for pregnant patients | | | |
| Yes, management would change <i>prior to delivery</i> | 66 (82) | 63 (73) | 0.10 |
| Less likely to treat with medications | 12 (15) | 18 (21) | 0.32 |
| More likely to delay induction of labour | 17 (21) | 12 (14) | 0.21 |
| More likely to increase home BP monitoring | 7 (9) | 6 (7) | 0.67 |
| Yes, management would change during labour | 34 (42) | 30 (35) | 0.27 |

*Statistical analyses exclude missing values

Table 4. Physicians' rankings of the top three barriers to use of self or ambulatory BP monitoring in pregnant patients

| Obstetricians | Primary care physicians |
|--|--|
| 1. Not sure about the validity and accuracy of home BP devices | 1. Patients may become preoccupied with their BP or become anxious |
| 2. Patients may become preoccupied with their BP or become anxious | 2. Patients sometimes misreport the results of home monitoring |
| 3. No standard protocol for measuring and recording home readings | 3. Not sure about the validity and accuracy of home BP devices |

WCH. A direct comparison of these two monitoring techniques, using pregnancy outcomes, would be ideal.

To our knowledge, this is the first study to address physician preferences and practices regarding ABPM among pregnant women. With a survey response rate of 63%, we believe we have captured a sample that is reasonably representative of obstetricians and family physicians across Alberta. Our study has a number of limitations. Non-responders to the survey might have differed in their beliefs and practices from our study group. We have reported physician attitudes and practices in one province only. It is quite possible that these practices vary from area to area, depending on local expertise and resource availability. It is also possible that the obstetrical care providers studied may have provided a best case response to queries regarding their clinical practices and that an audit of their patient records might reveal a more diverse and inconsistent application of these beliefs and attitudes in the real world.

CONCLUSION

Obstetrical care providers in Alberta are aware that WCH is an issue among pregnant women. While ABPM is chosen in a minority of cases, both obstetricians and primary care physicians appear to have a strong preference to use self BP monitoring for further BP evaluation. Future research should address the utility of self BP monitoring in the prediction of pregnancy outcomes. Educational efforts should focus on quality control issues with self BP monitoring, including timing and technique of BP measurements, as well as selection of appropriate devices that have been validated for their accuracy in pregnancy and in women with preeclampsia.

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