European Journal of Obstetrics & Gynecology and Reproductive Biology 184 (2015) 103–107

Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.elsevier.com/locate/ejogrb

Blood pressure changes during the first stage of labor and for the prediction of early postpartum preeclampsia: a prospective study

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ARTICLE INFO

Article history:
Received 8 October 2014
Received in revised form 6 November 2014
Accepted 17 November 2014

Keywords:
Postpartum preeclampsia
Blood pressure
Labor
Prediction

ABSTRACT

Objective: To assess systolic (SBP) and diastolic (DBP) blood pressure values during labor and to analyze their predictive value for early postpartum preeclampsia.
Study design: This 6-month prospective observational study included 1435 women in labor who had no hypertensive disorders either before or during pregnancy. SBP and DBP were measured every 15 min during labor and signs of preeclampsia were checked for in the early postpartum period.
Results: Mean maximum SBP and DBP were significantly higher during the first stage of labor without any treatment compared to the last prenatal visit: 135 vs. 119 mmHg and 81 vs. 74 mmHg, respectively ($p < 0001$). Epidural analgesia had no effect on maximum SBP or DBP during labor whereas oxytocin administration moderately increased SBP (137.8 vs. 135.2 mmHg; $p < 0.05$).

Early postpartum preeclampsia was identified in 0.9% of the women. A maximum SBP equal or higher than 150 mmHg or DBP equal or higher than 91 mmHg during labor were predictive of early postpartum preeclampsia with a sensitivity of 77% and a specificity of 71%.
Conclusion: SBP and DBP values during labor are higher than those observed in the antepartum period. An SBP equal or higher than 150 mmHg or DBP equal or higher than 91 mmHg are associated with an increased risk of early postpartum preeclampsia.

Introduction

Hypertensive disorders of pregnancy represent a major cause of maternal and perinatal morbidity and mortality. Gestational hypertension complicates 6–7% of pregnancies and preeclampsia 2–7% [1,2]. Hypertension in pregnancy and in the postpartum period is currently diagnosed by a systolic blood pressure (SBP) greater than or equal to 140 mmHg and/or diastolic blood pressure (DBP) greater than or equal to 90 mmHg [1,3]. However, there are only a few relatively old studies that report normal values of blood pressure during the first stage of labor [4–6].

Labor is a unique physiological situation involving major hemodynamic changes which could considerably impact blood pressure. In addition, blood pressure during labor could also be affected by the administration of certain agents such as epidural analgesia and oxytocin. Consequently, there is a need to reevaluate the usual thresholds of abnormal blood pressure values during first stage of labor. One way to do this could be to analyze blood pressure values during pregnancy and labor and define blood pressure thresholds above which postpartum preeclampsia may occur.

The primary aim of our study was therefore to address the following question: what are the normal maximal SBP and DBP values of women during the first stage of labor and what are the influences of oxytocin and epidural analgesia on such values? The secondary aim was to investigate if blood pressure values during labor could be associated with the onset of de novo early postpartum preeclampsia in women without any history of hypertensive disease before admission to the birthing suite.

Materials and methods

During 6 months (November 2010–April 2011) we conducted a prospective longitudinal study in a tertiary care hospital (Centre Hospitalier Intercommunal de Créteil, France). Inclusion criteria

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http://dx.doi.org/10.1016/j.ejogrb.2014.11.020
0301-2115/

were women in labor with a singleton pregnancy after 22 weeks gestation (n = 1695). Exclusion criteria were women undergoing a pre-labor cesarean delivery (n = 181) and women with a hypertensive disorder during or before pregnancy (n = 79). Finally, 1435 women were prospectively analyzed (Fig. 1).

Blood pressure was measured using an automated oscillometric blood pressure measurement device, DINAMAP ProCare 300, at the prenatal visits, during labor and in the postpartum period. This device is intended for clinical and hospital use and measures blood pressure within a range of 0–290 mmHg. It uses the same algorithm as a mercury sphygmomanometry reference standard such as the Dinamap ProCare 400 which has an A/A accuracy grade for pregnancy and an A/B accuracy grade for preeclampsia [7]. Blood pressure was measured in women in a semi-recumbent position in the left or right arm with the cuff at the level of the heart. Blood pressure was measured every 15 min, during the whole of labor and up to 2 h postpartum in the labor ward. All blood pressure values during labor were printed out.

Epidural analgesia, oxytocin use and expulsive effort times were recorded. The epidural analgesic regimen consisted of ropivacaïne 0.12% with sufentanil 0.3 μg/mL in patient-controlled epidural analgesia (PCEA) mode with a perfusion of 5 mL/h and boluses of 5 mL every 10 min if needed. The oxytocin augmentation regimen consisted of 2 mUI/min with an increasing dose of 2 mUI every 20 min.

We identified the maximum SBP and DBP that occurred during first stage of labor for each woman. Aberrant values (i.e. a never repeated isolated increased blood pressure value greater than 20% when compared to the immediate previous and following value) were excluded. Data concerning the onset of early postpartum preeclampsia were collected for every woman on the day of hospital discharge. Supplementary data were collected a posteriori: SBP and DBP values during the last month of pregnancy at last prenatal visit. Preeclampsia was diagnosed according to the criteria of the Report of the National High Blood Pressure Education Program Working Group [1]: the association of hypertension (SBP greater than 140 mmHg and/or DBP greater than 90 mmHg) and proteinuria. Proteinuria was defined by a 24-h urine protein greater than or equal to 0.3 g.

Basic descriptive statistical analyses (mean, median, standard deviation, percentile distribution) were calculated with PRISM 5.0 (GraphPad Software Inc., La Jolla, USA). Categorical variables were compared with Fisher's exact test or Chi-square test as appropriate and continuous variables with unpaired two-tailed student t test. Blood pressure thresholds were determined by ROC analysis. Sensitivity, specificity for blood pressure thresholds were calculated. A p <05 was considered significant.

The local Ethics Committee (Groupe de Reflexion Ethique de Creteil, France) was approached for approval of the study but waived the requirement for formal approval due to the observational nature of this study.

Results

Baseline characteristics of the 1435 women included in the study are detailed in Table 1. The use of routine interventions (epidural analgesia and oxytocin) is detailed in Fig. 1.

SBP and DBP values were significantly higher during labor when compared to those at the last prenatal visit: for SBP 135 mmHg ± 17 vs. 119 mmHg ± 12, $p < 0.0001$ (Table 2) and for DBP 81 mmHg ± 13 vs. 74 mmHg ± 9, $p < 0.001$ (Table 3). Epidural analgesia did not influence maximum blood pressure during labor (Tables 2 and 3). SBP, but not DBP, increased significantly in women under epidural analgesia receiving oxytocin compared to those under

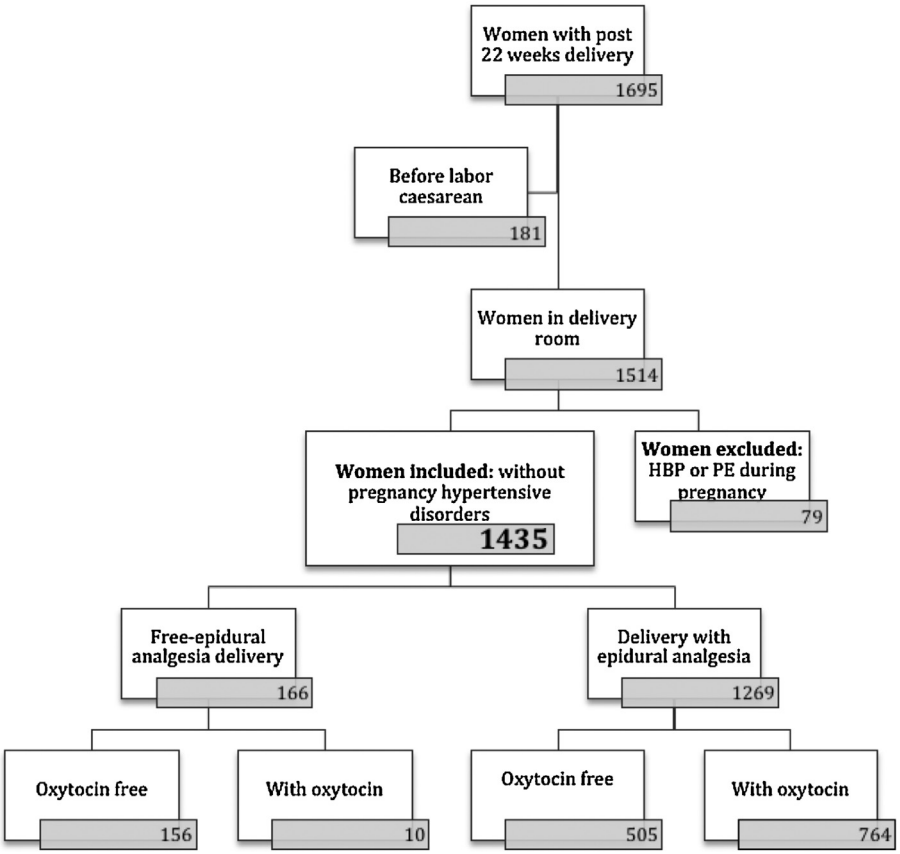

Fig. 1. Study flow chart. *Legend*: Study flow chart with an exhaustive description of patient selection and detailed description of the use of oxytocin and epidural analgesia. CHTN: chronic hypertension, GHT: gestational hypertension, PE: preeclampsia.