Journal of Hypertension: Open Access

Georges, et al., J Hypertens 2015, 4:2
DOI: 10.4172/2167-1095.1000199

Research Article Open Access

Hypertension in Pregnancy at the Teaching Hospital of Yalgado Ou é draogo, Burkina Faso

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Abstract

Introduction: Hypertension in pregnancy remains one of the leading causes of maternal and fetal morbidity and mortality worldwide. We aim to assess the prognostic pattern of hypertension (HPT)during pregnancy in the cardiology and obstetrics/gynaecology departments of Yalgado Ouédraogo University Hospital.

Patients and methods: An observational cohort study was conducted from July 1st 2012 to March 31st 2013 in pregnant women with HPTwho consent to participate. Follow-up visits were monthly performed.

Results: Overall 3247 pregnant women attended the Obstetrics/Gynaecology department and 312 were hypertensive. The prevalence of HPT during pregnancy was 9.6%. Study population comprised 126 patients who consented to participate in the study. Chronic HTP and preeclampsia accounted for 19% and 49.2 % of all cases respectively. The mean age was 29 ± 6.7 years. Antihypertensive drugs were used in 108 cases (85.7%). At least a bitherapy was found in 46 (36.5%). Cesarean section was the mode of delivery in 79 cases (62.7%). Blood pressure control was significantly higher in patients with new cases (gravidic HPT) compared to those with chronic hypertension over time. Eclampsia was observed in 19.8% and no maternal death occurred. Intrauterine fetal death and prematurity were found in 14.5% and 28.3% of fetuses. Proteinuria and hyperuricemia were associated with fetal complications.

Conclusion: Hypertension in pregnancy remains a public health concern in developing countries. Efforts should be made to strengthen and promote maternal and perinatal heath care.

Keywords: Hypertension; Preeclampsia; Eclampsia; Pregnancy; Burkina Faso

Introduction

Developing countries account for 99% of all 289 000 global maternal deaths with sub-Saharan Africa (SSA) regions alone accounting for 62 % in 2013 [1,2]. Hypertension (HPT) during pregnancy is a worrying issue despite the implementation of strategies aiming to improve maternal and child health. Hypertensive disorders in pregnancy are leading cause of maternal and perinatal mortality and morbidity [3-6]. The prevalence of HPT during pregnancy ranges up to12% worldwide [7-10]. In SSA data on hypertensive disorders in pregnancy are disparate, fragmentary and mainly hospital-based [4,10,11]. Due to their unpredictable nature and potential poor outcomes, patients with hypertensive disorders in pregnancy warrant cautious care with multidisciplinary team involvement to optimize both maternal and fetal outcomes [6]. So far, data are not available regarding the prognosis of HPT in pregnancyin our setting. Thus, we aim to assess the evolutive pattern of HPT during pregnancy in the cardiology and obstetrics/gynaecology departments of Yalgado Ouédraogo University Hospital.

Material and Methods

It was an observational cohort study, conducted in the cardiology and obstetrics/gynaecology departments of Yalgado Ouédraogo University Hospital during a nine months period from July 1st 2012 to March 31st 2013. Yalgado Ouédraogo University Hospital is the largest tertiary referral health center in Burkina Faso, West Africa.

Were included in the study:

- pregnant women with HPT diagnosed before or during the current pregnancy
- newly delivered women with HPT diagnosed less than one week after delivery
- and those who consent to be part of the study

Patients with abnormal ova or molar pregnancy were not included in the study.

Visits were scheduled as follows:

- **Inclusion visit:** the day of diagnosis for new cases who gave their informed consent to participate in the study was considered as the day of enrollment. Enrollment period lasted for six consecutive months.
- **Follow up visits:** were conducted monthly. After delivery, patients were followed up over a three months period. Newborn were followed up over 48 hours.
- **Random visits:** refer to visits that were not planned in the study. They aimed at capturing eventual morbidity data. Follow up visits were all conducted in the cardiology and obstetrics/gynecology

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Received January 09, 2015; **Accepted** May 30, 2015; **Published** June 06, 2015

Citation: Georges MRC, Aristide YR, Germain MD, Camille S, Temoua ND (2015) Hypertension in Pregnancy at the Teaching Hospital of Yalgado Ouédraogo, Burkina Faso. J Hypertens 4: 199. doi:10.4172/2167-1095.1000199

departments.

- Patients included could withdraw from the study at any point on time. Patients who failed to attend at least three consecutive visits were considered as losses to follow up. Nevertheless, for the mortality study, those patients or their families were called back for data completion.

Eclampsia refers to the occurrence of one or more generalized convulsions and/or coma in the setting of pre-eclampsia and in the absence of other neurological conditions [6]. Blood pressure level was classified by stage according to European Society of Hypertension [12]. Patients' compliance to treatment was assessed by the Xavier Girerd test. This test is based on five questions (yes/no). One point is allocated to each answer with yes, where as a response with no gives zero point with a maximum of five points. Zero point is considered as good compliance, 1-2 points corresponds to minor problems of compliance and ≥ 3 points means poor compliance [13]. The 24 hours proteinuria was positive for a value >300 mg/24 hours. Chronic HPT referred to patients with past history of HPT or diagnosed HPT beforethe first 20 weeks amenorrhea [14]. Data were analyzed with the statistic software R [15]. Means and ratio were compared with the ANOVA and Chi 2 tests. Logistic regression was used to assess maternal and fetal complications relationship with the other parameters. The Cox model was used to calculate the probability of controlling HPT. Tests were statistically significant for $p<0.05$.

Participation in the study did not offer any direct benefit to patients and did not expose them to any additional risk apart from those related to the management. The study did not require any additional act from the medical practitioner other than what he had initiated.

Results

During the study period, 3247 pregnant women attended the Obstetrics/Gynecology department. Among those patients, 312 were hypertensive (9.6%). We included 126 hypertensive patients in the study. Hundred and eighty six patients (59.6%) did not consent to be part of the study because they were too far from the hospital (n=125) or they wished to be followed up out of the hospital (n=51) or they simply opposed a rebuttal (n=10). During follow up period, we recorded 25 losses to follow up in the first month (n=20), second month (n=2) and third month (n=3) post-partum.

The mean age was 29 ± 6.7 years [16-40]. One hundred and eleven patients (88.1%) were residing in Ouagadougou. Table 1 describes the socio-demographic characteristics of the study population.

The mean gravida was 2 ± 1.6 [1-9] and the mean parity was 1 ± 1.5 [8]. Six patients (4.8%) had a past history of preeclampsia and 24 patients (19 %) had chronic HPT. The mean number of prenatal care visits was 4 ± 1 [1-7]. Table 2 shows the distribution of study patients according to their past medical history. HPT was diagnosed in the third trimester in 86 cases (84.3%). In the all study population, the mean systolic blood pressure (SBP) was 170 ± 21.7 mmHg (110-220) and the mean diastolic blood pressure (DBP) was 110 ± 18.6 mmHg (70-180). The mean SBP in chronic hypertensive patients was 177.9 ± 24.5 mmHg (130-220) and the mean DBP was 111 ± 24.1 mmHg (70-160). For the new cases of HPT (gestational HPT and preeclampsia), the mean SBP was 166.4 ± 20.5 mmHg (110-220) and the mean DBP was 108.8 ± 17.2 mmHg (90-180). Chronic hypertensive patients had higher SBP than the new cases (p=0.019). Table 3 shows the distribution of patients according to clinical parameters.

Characteristic	Number (n)	Percentage (%)
Age range (years)		
≤ 19	14	11.1
20 - 24	25	19.8
25 - 29	29	23
30 - 34	27	21.4
35 - 39	24	19.1
≥ 40	7	5.6
Educational level		
Primary school	36	28.6
College	43	34.1
University	12	9.5
Uneducated	35	27.8
Marital status		
Single	12	9.5
Living together	27	21.4
Married	87	69.1
Residence		
Ouagadougou	111	88.1
OutsideOuagadougou	15	11.9

Table 1: Distribution of all 126 study patients according to socio-demographic characteristics

Medicalhistory	Number (n)	Percentage (%)
Gravida		
Primigravida	46	36.5
Paucigravida	52	41.3
multigravida	28	22.2
Parity		
Nullipara	52	41.3
Primipara	28	22.2
Paucipara	39	29.4
Multipara	9	7.1
Cardio-vascular risk factors		
Alcohol	24	19.1
Sedentarity	97	77
Obesity	29	23
Dyslipidemia	1	0.8
Non-steroidal anti-inflammatory drugs use	46	36.5
Oral estrogen-progesterone use	19	15.1
Diabetes	0	0
Smoking	0	0
Number of prenatal care visits		
0	0	0
3-Jan	58	46
> 3	68	54

Table 2: Distribution of all 126 patients according to their past medical history

All 126 study patients had electrocardiogram and left ventricular hypertrophy was recorded in 14 cases (11.1%). Echocardiography was also performed in all patients recording left ventricular hypertrophy and left atrium dilatation respectively in twenty-four cases (19%). Left atrium dilatation was found in 33% of those with left ventricular hypertrophy on echocardiography versus 15.7% in those without [RR=2.12; 95%CI (1.04 – 4.4); p=0.03]. Proteinuria was positive in

80 patients (63.5%). Table 4 describes the patients' paraclinic features. Preeclampsia was the type of HPT in 62 cases (49.2%). Figure 1 shows the classification of hypertension in pregnancy in all study patients.

Patients' management comprised use of antihypertensive drugs in 108 cases (85.7%). At least a bitherapy was found in 46 (36.5%). Women with left ventricular hypertrophy received at least one antihypertensive drug including calcium antagonists (12 cases), methyldopa (19 cases), beta-blockers (2 cases), diuretics (1 case) and angiotensin converting enzyme inhibitors/angiotensin receptor blockers (2 cases in post - partum setting with stillbirth). Distribution of study patients according to pharmacological treatment is shown in Table 5. Cesarean section was the mode of delivery in 79 cases (62.7%). Patients' compliance with treatment was poor in 42 cases (42.8%). Blood pressure target was achieved in 86 over 103 patients (83.5%) at the end of follow up period (Figure 2). Blood pressure control was significantly higher in patients with new cases (gravidic HPT) compared to those with chronic hypertension over follow up time period (Figure 3).

We recorded at least one complication among 30 patients (23.8%) and no maternal death occurred. Fetal complication was noticed in 85 cases (61.6%) and neonatal and/orfetal death occurredin 24 cases (17.4%). Table 6 presents the distribution of maternal and fetal complications. Factors associated with occurrence of complications are shown in Table 7.

Parameter	Number (n)	Percentage (%)
Time period of hypertension discovery		
Chronic hypertension	24	19
2nd trimester	7	5.6
3rd trimester	86	68.3
Post-partum	9	7.1
Blood pressure stage		
Stage 1	20	15.9
Stage 2	41	32.5
Stage 3	65	51.6

Table 3: Distribution of all 126 study patients according to clinical parameters.

Findings	Number (n)	Percentage (%)
ElectrocardiogramTable 1		
Normal	51	40.5
Left ventricular hypertrophy	14	11.1
Left atrial hypertrophy	32	25.4
Other abnormalities*	29	23
Echocardiography		
Normal	100	79.4
Left ventricular hypertrophy	24	19
Impaired left ventricular EF	12	9.5
Dilated left ventricle	16	12.7
Dilated left atrium	24	19
24 hours proteinuria (gram)		
< 0.3	46	36.5
0.3 - 3	39	31
5-Mar	18	14.3
≥ 5	23	18.2

* Incomplete bundle branch block, atrial premature complexes, monomorphic ventricular

complexes, 1rst degree of atrioventricular block;

EF: Ejection fraction

Table 4: Distribution of study patients according to paraclinic findings (n=126)

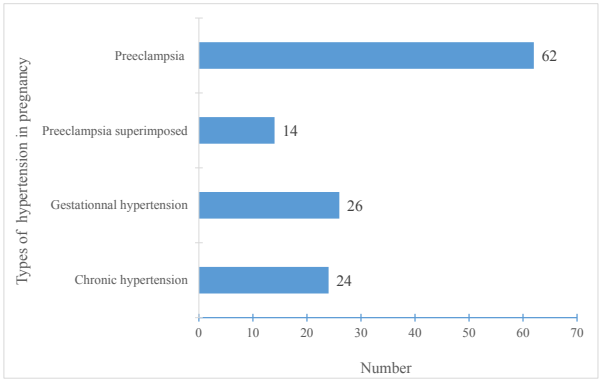

Figure 1: Classification of hypertension in pregnancy in all 126 study patients.

	Number (n)	Percentage (%)
Antihypertensive drugs		
Centrally active agents*	99	78.6
Calcium blockers	44	34.9
Beta-blockers	8	6.3
Diuretics	3	2.4
ACE/ARBs	3	2.4
Intravenousmagnesium sulfate	25	19.8
Number of antihypertensive drugs per patient		
0	18	14.3
1	62	49.2
2	44	34.9
3	1	0.8
4	1	0.8

*Methyldopa or clonidine; ACE: angiotensin-converting enzyme inhibitors; ARBs: angiotensin receptor blockers.

Table 5: Distribution of study patients according to pharmacological treatment

Discussion

This current study has shown a prevalence of hypertension during pregnancy of 9.6% supporting data from literature [7,8,10]. Chronic HPT accounted for 19% of our study patients. Chronic HPT and pregnancy-induced HPT have different pathophysiologies. Usually essential and prior to the pregnancy, chronic HPT is however associatedwith25% risk of superimposed preeclampsia and the HPT shall persist after delivery [14,16,17]. Despite that risk, those women also have the right to procreate and pregnancy should be well planned with cautious to avoid complications.

Only 43.6% of our study patients had received at least a college education which is lower than that of Adu-Bonsaffoh et al. [16] in

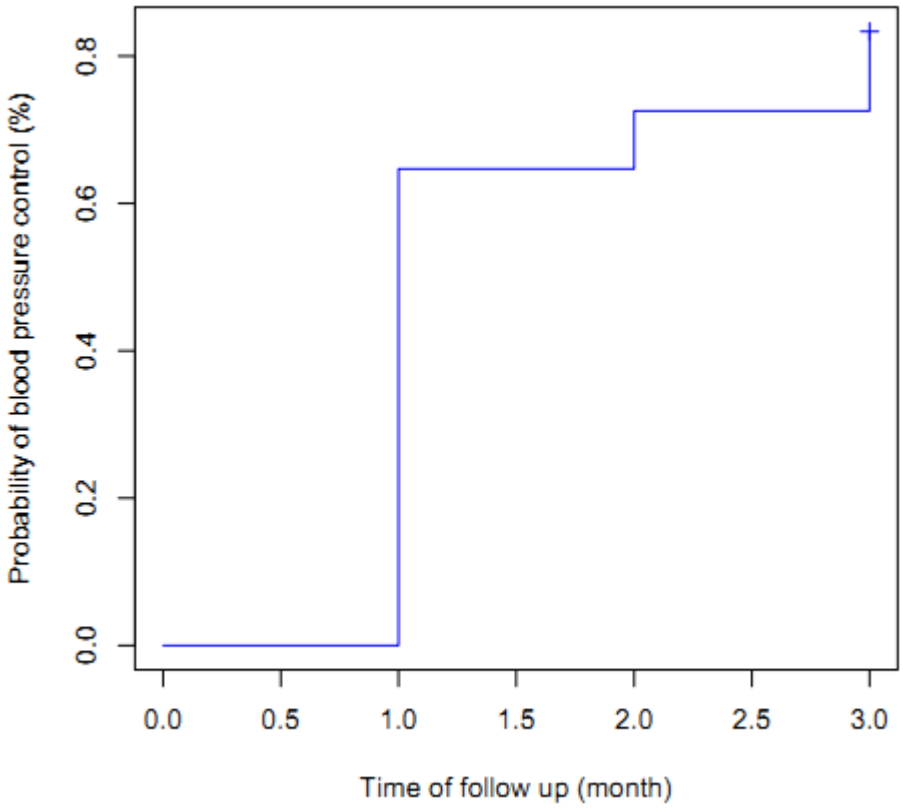

Figure 2: Probability of blood pressure control over time.

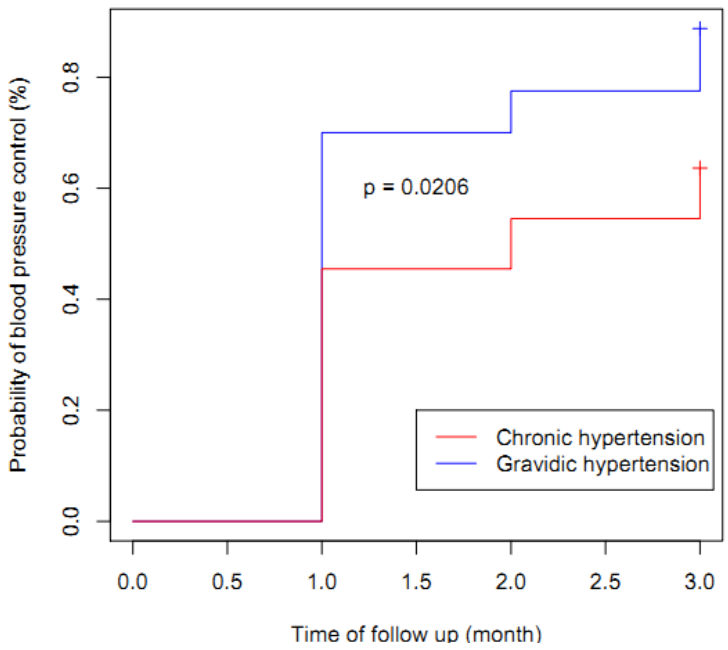

Figure 3: Probability of blood pressure control over time according to type of hypertension during pregnancy

Complications	Number (n)	Percentage (%)
Maternal complications (n=126)		
Eclampsia	25	19.8
Placental abruption	4	3.2
HELLP syndrome	1	0.8
Heart failure	2	1.6
Stroke	2	1.6
Renal failure	11	8.7
Fetalcomplications (n=138)		
Small for gestational age fetus	61	44.2
Prematurity	39	28.3
Intrauterine fetal death	20	14.5
Fetal life-threatening event	6	4.3

Table 6: Distribution of maternal and fetal complications inall study patients

Risk factor	RR (CI 95%)	P-value
Maternalcomplications		
Positive 24 hoursproteinuria	2.5 (0.8 – 4.5)	0.16
Chronic hypertension	0.3 (0.07 – 1.06)	0.09
Hyperuricemia	2.0 (0.8 – 5.3)	0.16
Hypertension stage 1	0.8 (0.2 – 2.8)	0.75
Hypertension stage 2	0.5 (0.2 – 1.5)	0.27
Hypertension stage 3	1.1 (0.9 – 1.4)	0.12
Fetalcomplications		
Maternalcomplications	1.4 (0.5 – 3.8)	0.5
Chronic hypertension	2.7 (0.8 – 9.2)	0.11
Hyperuricemia	3.9 (1.3 – 11.5)	0.01
Positive 24 hours proteinuria	3.3 (1.0 – 10.6)	0.04
Hypertension stage 1	0.8 (0.4 – 1.4)	0.22
Hypertension stage 2	0.4 (0.2 – 1.9)	0.32
Hypertension stage 3	1.4 (0.4 – 4.2)	0.59

Table 7: Factors associated with maternal and fetal complications

Accra with 77.2% of the cases. Patients' enrollment process could partly explain these discrepancies between the levels of education. We reported a marital/cohabitation status in 90.5% of women with hypertension in pregnancy supporting findings from Korle Bu Teaching Hospital in Ghana with 80.1% of the cases [16].

The mean gravida of our patients was 2 ± 1.6 and the mean parity was 1 ± 1.5. It has been reported that primigravida and primiparity predisposed to preeclampsia [10,18]. Pregnancy-induced HPT was shown to besix fold more frequent in primiparous women in France [19]. Risk factors for pre-eclampsia represent a bewildering array of causative antecedents that reflects the disease complexity. They included history of pre-eclampsia, primigravida and primiparity, pre-existing medical condition (hypertension, diabetes) older maternal age, multiple pregnancy [20].

Our data have shown a mean number of prenatal care visitsof4 ± 1. There is evidence that poor quality of antenatal consultations is not contributive for safer pregnancy and delivery. Prenatal care is essential for early detection of pathologies during pregnancy. Indeed, standard care in the management of hypertensive disorders in pregnancy might drastically reduce maternal and perinatal adverse outcomes [21]. We did not record any maternal death and no factor has been associated with the occurrence of maternal complications. A close collaboration in the management of study patients by both cardiologists and obstetricians/gynaecologists could possibly explain our results. However a WHO review has identified hypertension as the single cause of maternal mortality in industrialized countries with 16% of all deaths. Conversely in Africa and Asia hypertensive disorders accounted for 9% of maternal deaths [22]. More recent datain SSA have demonstrated that hypertensive disorders are currently leading cause of maternal mortality [4,23-26]. Higher mortality rates are observed with poor monitoring of the pregnancy and in Blacks (Afro-Americans) [27], probably suggesting that some independent factors could be associated with the pathology (health system and/or socio-economic level). Therefore, there is an urgent need to strengthen maternal health care facilities and provide standard care during pregnancy and also preconception period.

The 24 hours proteinuria was recorded high in 65% of the cases. Protein uria is an indicator of poor prognosis and is related to glomerular lesions. Raise in protein uria (>3g/l) is associated with the risk of severe preeclampsia. Proteinuria is pejorative when >1g/l and particularly appears before the 34th week of amenorrhea. It is an independent cardiovascular risk marker with a risk ratio of coronary events between 1.7 and 2. There is also a risk of progression towards chronic HPT in one quarter of the cases [9,28]. In fact, it is well known that up to 20% of women with hypertensive pregnancy disorders might persist with high BP levels after 6 weeks postpartum thus develop chronic hypertension [29-31].

We reported an eclampsia occurrence in 19.8% of hypertensive patients. This rate was higher than those reported by Adu-Bonsaffoh [16] and Buga [32] with respectively 15.8% and 11%.

The American College of Obstetricians and Gynecologists has recently completed a review of the management of hypertension in pregnancy by a task force of experts in the field. Systolic blood pressure ≥ 160 mmHg and diastolic blood pressure ≥ 105 mmHg should be treated. They recommended labetalol, nifedipine and methyldopa for initial management of hypertension in pregnancy. One recommendation cautioned against the use of angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, renin inhibitors, and mineralocorticoid receptor antagonists in pregnancy [33]. Women with severe preeclampsia should be closely monitored and receive intravenous magnesium sulfate [34]. Cesarean section rate among women with hypertensive disorders in pregnancy was 62.7% in our findings and was higher than that of 45.7% reported by Adu-Bonsaffoh in Ghana [16] and 34% reported by Wolde in Ethiopia [35], but lower than the 90.8% reported by Olusanya et al in Nigeria [36].

In the present study, the risk of fetal complications was 3.3 fold higher when proteinuria was positive and 3.9 fold higher in patients with hyperuricemia. This risk was 10 fold higher when both anomalies were associated. Indeed, when proteinuria was significant, the risk of fetal complications was significantly greater. Hyper uricemia is also a pejorative prognostic criteria. Perinatal mortality is significantly increased among hypertensive pregnant women with hyper uricemia compared to those having the same grade of HPT with normal plasma uric acid level [37,38]. We reported 14.5% of intrauterine fetal death. Studies showed that preeclampsia is associated with a two-fold increased risk of stillbirth [39]. Prematurity state was found in 28.3% of 138 fetuses in our study. Women with severe preeclampsia have an 80-fold increased risk of iatrogenic preterm delivery before 33 weeks and a 40-fold increased risk between 33 and 36 weeks [40].

We considered the small number of patients and lack of controls as limitations of the current study. Therefore, the incidence of the maternal and fetal adverse outcomes determined might not reflect the

true population figures in Burkina Faso. However, the current results partly gave the burden of HPT in pregnancy.

Conclusion

Hypertension in pregnancy remains a frequent pathology and is a public health concern in developing countries. Severe forms lead to high rate of fetal and neonatal morbidity and mortality. Close antenatal monitoring and adequate management by a multidisciplinary team, improvement of technical equipment in the health centers and getting more qualified practitioners are conditions for better management of this pathology.

Conflict of Interest

The authors deny any conflict of interest in relation with this paper.

References

1. Nove A, Matthews Z, Neal S, Camacho AV (2014) Maternal mortality in adolescents compared with women of other ages: evidence from 144 countries. Lancet Glob Health 2: e155-164.
2. World Health Organization, others (2014) Trends in maternal mortality: 1990 to 2013. Estimates by WHO, UNICEF, UNFPA, THe World Bank and the United Nations Population Division. UNFPA, The World Bank and the United Nations Population Division, USA.
3. Gaudebout N, Lantelme P, Audra P (2010) Hypertension artérielle préexistanteetgrossesse. Prat En Anesth Réanimation 14: 151-157.
4. Adu-Bonsaffoh K, Oppong SA, Binlinla G, Obed SA (2013) Maternal deaths attributable to hypertensive disorders in a tertiary hospital in Ghana. Int J Gynaecol Obstet 123: 110-113.
5. Karolinski A, Mercer R, Micone P, Ocampo C, Mazzoni A, et al. (2013) The epidemiology of life-threatening complications associated with reproductive process in public hospitals in Argentina. BJOG 120: 1685-1694.
6. McCarthy FP, Kenny LC (2009) Hypertension in pregnancy. Obstet Gynaecol Reprod Med 19: 136-141.
7. Roberts CL, Ford JB, Algert CS, Antonsen S, Chalmers J, et al. (2011) Population-based trends in pregnancy hypertension and pre-eclampsia: an international comparative study. BMJ Open 1: e000101.
8. van Middendorp D, ten Asbroek A, Bio FY, Edusei A, Meijjer L, et al. (2013) Rural and urban differences in blood pressure and pregnancy-induced hypertension among pregnant women in Ghana. Global Health 9: 59.
9. Callaway LK, Mamun A, McIntyre HD, Williams GM, Najman JM, et al. (2013) Does a history of hypertensive disorders of pregnancy help predict future essential hypertension? Findings from a prospective pregnancy cohort study. J Hum Hypertens 27: 309-314.
10. Baragou S, Goeh-Akue E, Pio M, Afassinou YM, Atta B (2014) [Hypertension and pregnancy in Lome (sub-Saharan Africa): epidemiology, diagnosis and risk factors]. below Ann Cardiol Angeiol (Paris) 63: 145-150.
11. Thieba B, Lankoande J, Akotionga M, et al. (2003) Hématomerétroplacentaire?: aspects épidémiocliniques et pronostiques à propos d'unesérie de 177 cas. Gynécologie Obstétrique Fertil 31:429–433.
12. Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, et al. (2013) 2013 ESH/ESC guidelines for the management of arterial hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). Eur Heart J 34: 2159-2219.
13. Girerd X, Hanon O, Anagnostopoulos K, Ciupek C, Mourad JJ, et al. (2001) [Assessment of antihypertensive compliance using a self-administered questionnaire: development and use in a hypertension clinic]. Presse Med 30: 1044-1048.
14. (2000) Report of the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy. Am J Obstet Gynecol 183: S1-1S22.
15. Dean CB, Nielsen JD (2007) Generalized linear mixed models: a review and some extensions. Lifetime Data Anal 13: 497-512.
16. Adu-Bonsaffoh K, Obed SA, Seffah JD (2014) Maternal outcomes of hypertensive disorders in pregnancy at Korle Bu Teaching Hospital, Ghana. Int J Gynaecol Obstet 127: 238-242.
17. Ros HS, Cnattingius S, Lipworth L (1998) Comparison of risk factors for preeclampsia and gestational hypertension in a population-based cohort study. Am J Epidemiol 147: 1062-1070.
18. Vangeenderhuysen C, Banos JP, Amadou IA (1999) Hypertension artérielle au cours du troisièmetrimestre de grossesse. Etude des facteurs de risqueaisémentidentifiables à la première consultation prénatal au niger. Rev Fr Gynécologie Obstétrique 94: 369-373.
19. Mounier-Vehier C, Valat-Rigot AS, Vaast P, Puech F, Carré A (1994) [Evaluation and surveillance of blood pressure during pregnancy]. J Gynecol Obstet Biol Reprod (Paris) 23: 303-307.
20. Hutcheon JA, Lisonkova S, Joseph KS (2011) Epidemiology of pre-eclampsia and the other hypertensive disorders of pregnancy. Best Pract Res ClinObstetGynaecol 25: 391-403.
21. Baldwin KJ, Leighton NA, Kilby MD, Wyldes M, Churchill D, et al. (2001) The West Midlands "Severe Hypertensive Illness in Pregnancy" (SHIP) audit. Hypertens Pregnancy 20: 257-268.
22. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Van Look PF (2006) WHO analysis of causes of maternal death: a systematic review. Lancet 367: 1066-1074.
23. Lee QY, Odoi AT, Opare-Addo H, Dassah ET (2012) Maternal mortality in Ghana: a hospital-based review. Acta Obstet Gynecol Scand 91: 87-92.
24. Oladapo OT, Lamina MA, Fakoya TA (2006) Maternal deaths in Sagamu in the new millennium: a facility-based retrospective analysis. below BMC Pregnancy Childbirth 6: 6.
25. Tebeu PM, Ngassa P, Kouam L, Major AL, Fomulu JN (2007) Maternal mortality in Maroua Provincial Hospital, Cameroon (2003-2005). West Indian Med J 56: 502-507.
26. Moodley J; National Committee on Confidential Enquiries into Maternal Deaths, National Department ofHealth, South Africa (2011) Maternal deaths associated with hypertension in South Africa: lessons to learn from the Saving Mothers report, 2005-2007. Cardiovasc J Afr 22: 31-35.
27. Callaghan WM (2012) Overview of maternal mortality in the United States. Semin Perinatol 36: 2-6.
28. Mounier-Vehier C, Delsart P (2009) [Pregnancy-related hypertension: a cardiovascular risk situation]. Presse Med 38: 600-608.
29. Kurabayashi T, Mizunuma H, Kubota T, et al. (2013) Pregnancy-induced hypertension is associated with maternal history and a risk of cardiovascular disease in later life: A Japanese cross-sectional study. Maturitas 75: 227-231.
30. Suzuki H, Watanabe Y, Arima H, Kobayashi K, Ohno Y, et al. (2008) Short- and long-term prognosis of blood pressure and kidney disease in women with a past history of preeclampsia. Clin Exp Nephrol 12: 102-109.
31. Ghossein-Doha C, Peeters L, van Heijster S, van Kuijk S, Spaan J, et al. (2013) Hypertension after preeclampsia is preceded by changes in cardiac structure and function. Hypertension 62: 382-390.
32. Buga GA, Lumu SB (1999) Hypertensive disorders of pregnancy at Umtata General Hospital: perinatal and maternal outcomes. East Afr Med J 76: 217-222.
33. American College of Obstetricians and Gynecologists; Task Force on Hypertension in Pregnancy (2013) Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologistsâ€™ Task Force on Hypertension in Pregnancy. Obste Gynecol 122: 1122-1131.
34. Vest AR, Cho LS (2012) Hypertension in pregnancy. Cardiol Clin 30: 407-423.
35. Wolde Z, Segni H, Woldie M (2011) Hypertensive disorders of pregnancy in jimma university specialized hospital. Ethiop J Health Sci 21: 147-154.
36. Olusanya BO, Solanke OA (2012) Perinatal outcomes associated with maternal hypertensive disorders of pregnancy in a developing country. Hypertens Pregnancy 31: 120-130.
37. Varma TR (1982) Serum uric acid levels as an index of fetal prognosis in pregnancies complicated by pre-existing hypertension and pre-eclampsia of

pregnancy. Int J Gynaecol Obstet 20: 401-408.

38. Voto LS, Illia R, Darbon-Grosso HA, Imaz FU, Margulies M (1988) Uric acid levels: a useful index of the severity of preeclampsia and perinatal prognosis. J Perinat Med 16: 123-126.

39. Villar J, Carroli G, Wojdyla D, Abalos E, Giordano D, et al. (2006) Preeclampsia, gestational hypertension and intrauterine growth restriction, related or independent conditions? Am J Obstet Gynecol 194: 921-931.

40. Ananth CV, Savitz DA, Williams MA (1996) Placental abruption and its association with hypertension and prolonged rupture of membranes: a methodologic review and meta-analysis. Obstet Gynecol 88: 309-318.