RMMG
Revista Médica de Minas Gerais

ORIGINAL ARTICLE

Analysis of the epidemiological profile and hospital evolution of pregnant women with hypertensive syndromes

Análise do perfil epidemiológico e evolução hospitalar de gestantes com síndromes hipertensivas

Patrícia Gonçalves Teixeira[1], Eura Martins Lage[1], Mário Dias Corrêa Júnior[1], Marina Ribeiro Bartholo[2], Anna Luiza Rocha Queiroz[2], Lorena Almeida Silva[2], Zilma Silveira Noqueira Reis[1]

ABSTRACT

Introduction: Hypertensive disorders in pregnancy remain a global challenge for the reduction of maternal morbidity and mortality, especially in low and middle income countries. In Brazil, it is estimated that the prevalence is 10%, being the main cause of maternal deaths. **Objective:** This study aims to analyze the profile of pregnant women with hypertensive disorders at childbirth and to associate them with maternal and perinatal outcomes. **Methods:** In a retrospective cross-sectional database analysis, all childbirth hospitalizations in a public maternity hospital were analyzed the period before the SARS-CoV-2 pandemic. Prenatal and perinatal factors were associated with maternal and neonatal outcomes by comparing women with or without hypertension in pregnancy. **Results:** In the period studied, 12,433 pregnant women were admitted to the maternity ward. For this study, 11,173 patients were eligible and 754 (6.8%) had some form of hypertension during pregnancy, and 10,409 (93.2%) were considered in control group. Factors associated with hypertension were: age of the woman (mean 32.5 years versus 31.5 years, p<0.001), diabetes (14.8% versus 10.6%, p=0.001), twin pregnancy (4.3% *versus* 2.3%, p<0.001), thrombocytopenia (1.6% versus 0.5%, p<0.001) with hypertensive and non-hypertensive, retrospectively. In relation to childbirth and immediate complications, a cesarean section it was more frequent in the hypertensive group (71.3%), as was premature birth (39.9%), near miss (9.5%) and ICU admission (5.6%), in relation to non-hypertensive women. Regarding the neonatal outcome, birth weight was lower (mean 2595 versus 2999 grams, p<0.001), Apgar at the 1st and 5th minutes was lower (p<0.001) and the need for Intensive Care Center (ICC) was higher in the non-hypertensive group (p<0.001). **Conclusion:** Hypertension in pregnancy remains associated with worse maternal and neonatal hospital outcomes

[1] Department of Gynecology, Faculty of Medicine, UFMG, Belo Horizonte, Minas Gerais, Brazil.

[2] Faculty of Medicine, UFMG, Belo Horizonte, Minas Gerais, Brazil.

Responsible Editor::

Dr. Henrique Leite

Faculdade de Medicina da Universidade Federal de Minas Gerais

Belo Horizonte/MG, Brasil.

Corresponding Author:

Eura Martins Lage

Department of Gynecology and Obstetrics, Faculty of Medicine, Federal University of Minas Gerais, Belo Horizonte, Brazil

E-mail: euramartinslage@gmail.com

Conflict of Interests:

The authors declare no conflict of interest during the development of this study.

Supporting Sources:

There are no supporting sources

Ethics Committee:

CAAE 36334220.8.0000.5149

Received on: January 22th, 2024.

Approved on: dia mês June 10th, 2024.

Publication Date: February 25th, 2025.

DOI: 10.5935/2238-3182.2024e34119-en

compared to non-hypertensive women. Effective prenatal and delivery strategies are still essential policies for the prevention of complications and harm reduction in the target population.

Keywords: Hypertensive disorders; Database analysis; Outcomes.

RESUMO

Introdução: As desordens hipertensivas na gravidez mantêm-se como um desafio mundial para efetiva redução da morbidade e mortalidade materna, em especial nos países de baixa e média renda. No Brasil, estima-se que a prevalência seja de 10%, sendo a principal causa de mortes maternas. **Objetivo:** Este estudo tem por objetivo analisar o perfil das gestantes com distúrbios hipertensivos no momento do parto e associá-los aos desfechos maternos e perinatais. **Métodos:** Em uma análise retrospectiva de banco de dados transversal, foram analisadas todas as internações de parto em uma maternidade pública no período anterior à pandemia do SARS-CoV-2. Fatores pré-natais e perinatais foram associados aos desfechos maternos e neonatais comparando mulheres com ou sem hipertensão na gravidez. **Resultados:** No período estudado, 12.433 gestantes foram internadas na maternidade. Das 11.173 pacientes elegíveis, 754 (6.8%) apresentaram alguma forma de hipertensão na gravidez e 10.409 (93.2%) foram consideradas no grupo-controle. Fatores que se associaram à hipertensão foram idade da mulher (média 32,5 anos *versus* 31,5, p<0,001), diabetes (14.8% versus 10.6%, p=0,001), gemelaridade (4.3% versus 2.3%, p<0,001), plaquetopenia (1,6% *versus* 0,5%, p<0,001) hipertensas e não hipertensas, retrospectivamente. Em relação ao parto e complicações imediatas, a cesariana foi mais frequente no grupo de hipertensas (71,3%), assim como o parto prematuro (39,9%), *near miss* (9,5%), hemotransfusões (5,4%), admissão em Centro de Terapia Intensiva (CTI) (5,6%), em relação às não hipertensas. Quanto ao resultado neonatal durante o período de internação, o peso ao nascer foi menor (média 2595 versus 2999 gramas, p<0,001), o escore de Apgar no 1º e 5º minutos foram inferiores (p<0,001) e a necessidade de cuidado intensivo neonatal e óbito nas salas de parto foi maior nos neonatos de mulheres hipertensas em relação às não hipertensas (p<0,001). **Conclusão:** A hipertensão na gravidez se mantém associada ao resultado materno e neonatal hospitalar pior em relação às não hipertensas, mesmo em um centro de referência para alta complexidade. Estratégias antenatais efetivas e no parto ainda são políticas essenciais para a prevenção das complicações e redução de danos na população-alvo.

Palavras-chave: Transtornos hipertensivos; Análise de banco de dados; Desfechos.

Introduction

In Brazil, it is estimated that the prevalence of hypertensive disorders is 10%, being the main cause of maternal death at the extremes of reproductive life[1]. Hypertensive disorders in pregnancy remain a global challenge for reducing maternal morbidity and mortality, especially in low and middle income countries[2]. Studies on hypertensive disorders in pregnancy have intensified in last decades, and these conditions often complicate the pregnancy-puerperal cycle and are associated with high rates of maternal and perinatal morbidity and mortality[3,4].

Hypertension in pregnancy is defined as a systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg, or both, in two measurements 4 hours apart, and is classified as previous arterial hypertension, pre-eclampsia (PE) or gestational hypertension[1-3]. PE, when present, complicates 25% of pregnancies and has a variable incidence depending on the presence of epidemiological risk factors[4-6].

A study by Morse (2011)[7] on a survey of publications about the cause of death in Brazil in 30 years identified that hypertension in pregnancy was the principal cause of maternal death in Brazil.

Pre-eclampsia is the second leading cause of maternal death worldwide, with estimates ranging from at least 16% among low and middle income countries to over 25% in some Latin American countries[1-3]. In Brazil, pre-eclampsia contributes to a quarter of all registered maternal deaths, being the main cause of maternal death[8].

PE occurs mainly at the end of the second and throughout the third trimester of pregnancy, and its pathophysiology is marked by systemic and progressive endothelial lesion[4,9]. Despite its uncertain etiology, it is known that this disease is a result of the unbalanced release of antiangiogenic factors and other cytokines by a dysfunctional placenta[10,11]. The signs and symptoms of PE are well known, and delivery with the removal of placental tissue is the definitive treatment[11,12]. Women who have had pre-eclampsia have an increased risk of developing cardiovascular diseases in the future, and the conceptus may develop hypertensive and metabolic diseases in adulthood[12,13].

Knowing the epidemiological risk factors of hypertensive diseases that are related to the outcomes of the mother/newborn binomial can generate measures to prevent serious complications even during prenatal care[14,15]. The measurement of blood pressure should be performed in all appointmens that precede childbirth. The main obstetric risk factors are known during childbirth and puerperium, which allows drawing up a plan for prenatal care and the institution of prophylactic measures to prevent severe cases of PE, such as the use of acetyl salicylic acid (ASA) and calcium supplementation in the face of nutritional deficiency[16-18]. Furthermore, all pregnant women, especially those at risk, should know the signs and symptoms of hypertension, be aware of the reference maternity hospital and seek timely care[19,20].

This study aims to analyze the profile of pregnant women with hypertensive disorders at the time of childbirth and to associate it with maternal and perinatal outcomes, to contribute to the improvement of care quality, revision of institutional protocols, and for the elaboration of public policies.

Methods

A retrospective cross-sectional study in a database gathered all admissions for childbirth at the Otto Cirne maternity ward of the Hospital das Clínicas at Federal University of Minas Gerais/Brazilian Hospital Services Company (UFMG/Ebserh), a quaternary reference in the public network of the state of Minas Gerais. At the institution, a computerized system called SISMATER® has a permanent and longitudinal repository of clinical data collected in a structured format from admission to discharge of the woman and newborn. The present study selected for analysis the pre-pandemic period of SARS-CoV-2 between the years 2014 to 2019. Among the 250 variables collected in the system by the attending physicians, 32 maternal variables and 7 newborn variables were selected to make up the epidemiological profile and clinical and obstetric hospital evolution. Complications in previous pregnancies were grouped into "bad obstetric past". Data on maternal mortality in the selected study period were collected at the Epidemiology Center of Hospital das Clínicas - UFMG. The study was approved by the Research Ethics Committee of UFMG under the number CAAE 36334220.8.0000.5149.

Among the 12,433 hospital birth records during the study period, 11,173 admissions were considered in the analysis because they had a gestational age above 20 weeks or birth weight greater than 500 g, in the absence of information on the gestational chronology. The excluded cases gathered records that were not childbirth (n=1010; 9.0%) and loss of the two variables that allowed defining the occurrence as childbirth (250; 2.2%) – Figure 1. The flowchart in Figure 2 and presents the selection of pregnant women and the variables studied. In this study, 11,173 pregnant women delivered and gave birth to 11,387 newborns. However, in the case of twins, only the first was considered to avoid duplication of maternal information

For data analysis, pregnant women who were diagnosed with hypertensive disorders during hospitalization were compared to those who did not. The group of hypertensive women gathered cases already known by the prenatal records as well as those that had manifestation only during hospitalization. For this, structured fields from the database and records with ICDs associated with hypertension were used: 0.14 - Pregnancy-induced pre-eclampsia, 0.16 - Pregnancy-specific maternal hypertension, 0.10 - Essential hypertension, 0.15 - Secondary hypertension, and 0.13 – Gestational hypertension. In this maternity hospital, the hypertensive disorders of pregnancy are diagnosed and classified according to the International Society for the Study of Hypertension in Pregnancy (ISSHP)[21]. As defined

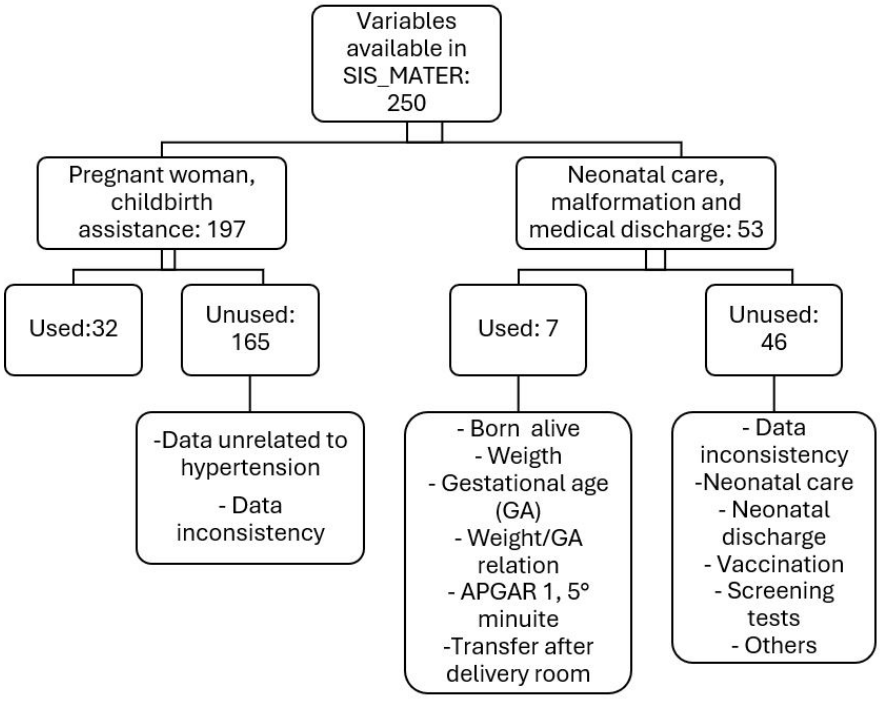

Figure 1. Organizational charts of eligibility criteria of variables in SIS-MATER.

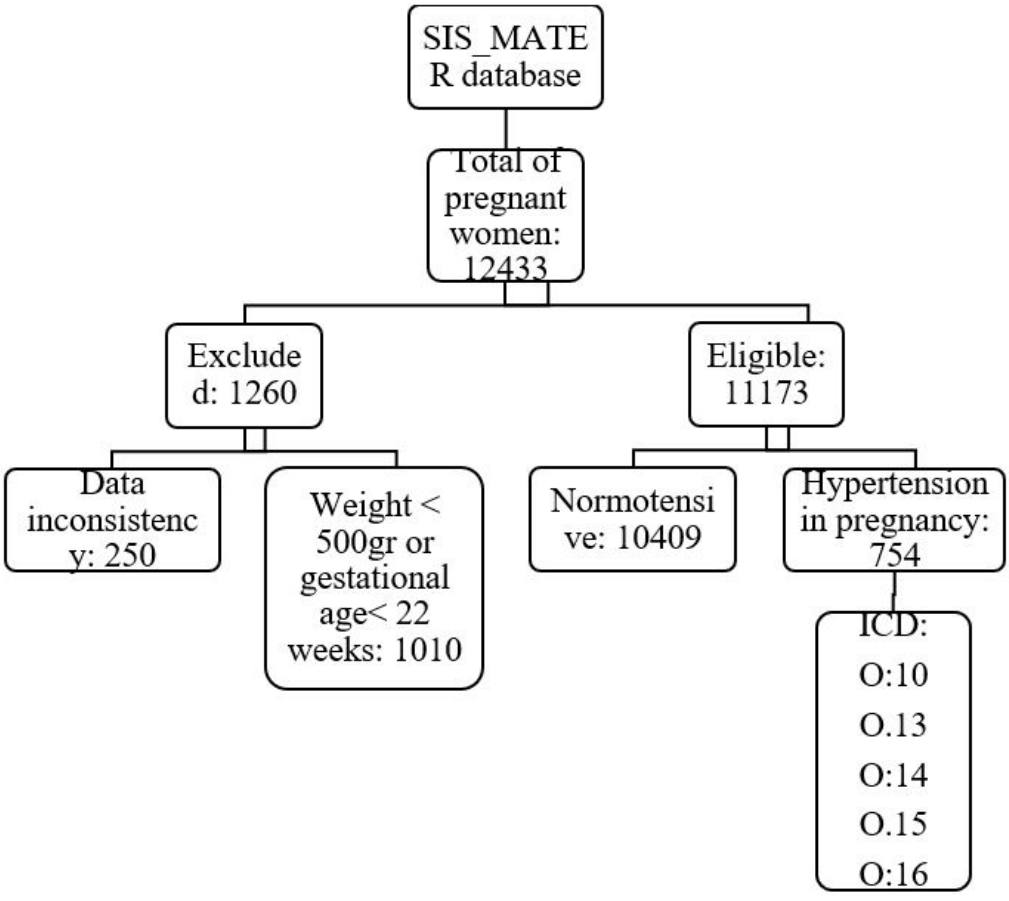

Figure 2. Organizational charts of eligibility criteria of pregnant women hospitalized for hypertensive disorders at Hospital das Clínicas between 2014 and 2019.

in the internal institutional protocol. According to this classification, hypertension is considered chronic when it precedes pregnancy or remains after 12 weeks of delivery or is present at the beginning of pregnancy; pre-eclampsia is hypertension that appears after 20 weeks of pregnancy associated with proteinuria or organic dysfunction, and gestational hypertension transitory elevation of blood pressure without clinical or laboratory signs of PE.

In the statistical analysis, the variables of interest were described as absolute and relative frequencies, as well as mean and standard deviation (SD), median and interquartile range (IQR). Then, the groups of hypertensive and non-hypertensive women were compared using Pearson's chi-square test, mean t-test, and Mann-Whitney test, according to the nature of the variable and its frequency distribution. The SPSS version 16 statistical program was used in the analysis and *p*-value <0.05 was considered significant.

Results

The frequency of hypertensive syndromes in pregnancy was 764 (7.3%) and 10,409 (93.2%) pregnant women were considered to the control group. Regarding the form of presentation of the hypertensive disease, 47 (17.9%) had chronic hypertension, 15 (2.9%) had eclampsia, whereas the others were considered to have other forms of pre-eclampsia 674 (88, 2%) or gestational hypertension 28 (3.7%). Table 1 presents the comparative analysis between the characteristics of the group of women who had some type of hypertension during pregnancy with those who did not. As it is a reference service, 1,129 (10.2%) came from other cities, with the most frequent transfer being in the hypertensive group (p<0.001). As for parity, 5,186 (46.9%) were nulliparous at admission but without association with hypertension in pregnancy (p=0.266). The presence of hypertension was associated with older maternal age (mean 32.5 versus 31.5 years, p<0.001), twins (4.3% versus 2.3%, p<0.001), thrombocytopenia (1.6% versus 0.5%, p<0.001), bad obstetric past (2.8% versus 1.6%, p<0.001), diabetes (14.8% versus 10.6%, p=0.001), occurrences for hypertensive and non-hypertensive women, retrospectively. Fetal complications such as intrauterine growth restriction (p<0.001) and oligohydramnios (p=0.003) were also associated with hypertension, but there was no significant difference in the occurrence of fetal death between the study groups (p=0.758).

Regarding childbirth and immediate complications, Table 2 shows that cesarean section was more frequent in the hypertensive group (71.3% versus 33.8%, p<0.001), as well as premature birth (39.9% versus 15.0% p<0.001), postpartum hemorrhage (5.8% versus 3.0%, p<0.001) frequencies for hypertensive and non-hypertensive women, respectively. Serious complications such as near miss (p<0.001), blood transfusion (p<0.001), and ICU admission (p<0.001) were associated with arterial hypertension. During the study period, 19 pregnant women died. Eighteen women died from non-hypertensive causes, such as leukemia, heart disease and others, and one death occurred in 2018 due to pre-eclampsia complicated by HELLP syndrome and postpartum hemorrhage. This pregnant woman was admitted to the ICU of Hospital das Clínicas after a cesarean section performed at 32 weeks of pregnancy in another delivery care institution. As for the neonatal outcome during the hospitalization period, Table 3 shows that birth weight was lower (mean 2,595 g versus 2,999, p<0.001), Apgar scores at 1st and 5th minutes were lower (p<0.001 for both), and the need for neonatal intensive care (35.0% versus 15.3%) and death in the delivery room (2.2% versus 1.9%) were higher in neonates of hypertensive women compared to non-hypertensive women (p<0.001).

Discussion

There is no way to avoid the indicators associated with pre-eclampsia but knowing data and installation of epidemiological data on the disease allows to select pregnant women for monitoring adequate prenatal care, to improve the follow-up of more severe conditions, and improve their health[22,23].

Birth-related data can be found in electronic maternity records or archives, but having a robust and computerized database allows the analysis of a large population group promptly. Based on this premise, SISMATER was implemented at the Otto Cirne HC/UFMG-Ebserh maternity hospital in 2012. Currently, this software has more than 250 variables that generate data for internal analysis and scientific studies.

Our study was a pioneer in analyzing epidemiological factors related to hypertension in pregnancy with maternal and perinatal outcomes using SISMATER data. We found that characteristics such as the pregnant woman's age, poor obstetric history, presence of diabetes, twins and oligohydramnios are associated with hypertension during pregnancy and these are risk factors that can be identified during prenatal care, defining, prior to birth, differentiated care flows. Another fact of interest was the development of serious obstetric conditions such as near miss, need for ICC, blood transfusion and hemorrhage in the group of pregnant women with hypertension. It shows that facing a pregnant woman with hypertension alerts to the risk of complications and the possible need for a more complex hospital unit.

The relationship between maternal near miss cases and maternal death can provide information on the preventability of death. Hemorrhage and pre-eclampsia are the principal causes of ICU admission for obstetric complications and have relatively low mortality rates, perhaps demonstrating the impact of care in the management of critical obstetric illnesses[24].

Associating hypertensive syndrome and perinatal outcomes during pregnancy, the group with high blood pressure presented perinatal outcomes such as prematurity, low birth weight and cesarean section at a higher prevalence than the group without high blood pressure, which is in line with data from literature[25-27].

Table 1. Epidemiological characteristics of pregnant women upon admission.

	Valid datta (N[1] = 11173)	**Present hypertension** (N[2] = 754)	**Absent hypertension** (N[3] = 10409)	p
Woman's age in years, mean (SD)	11173	32,5 (7,4)	31,5 (7,0)	<0,001*
Diabetes , n/N2 (%) and n/N3 (%)	9415	112 (14,8)	916 (10,6)	<0,001**
Twins pregnancy, n/N2 (%) and n/N3 (%)	9308	32 (4,3)	194 (2,3)	<0,001**
Collagen disease, n/N2 (%) and n/N3 (%)	9415	5 (0,7)	43 (0,5)	0.542**
Nephropathy, n/N2 (%) and n/N3 (%)	9415	4 (0,5)	21 (0,2)	0,142**
Drug addction[1], n/N2 (%) and n/N3 (%)	9415	19 (2,2)	204 (2,4)	0,852***
Parity, median (IIQ)	11173	2 (1)	2 (1)	0,202***
Nulliparity, n/N2 (%) and n/N3 (%)	11064	341 (44,9)	4845 (47,0)	0,266**
Bad obstetric past, n/N2 (%) and n/N3 (%)	9415	21 (2,8)	140 (1,6)	0,018**
Thrombocytopenia, n/N2 (%) and n/N3 (%)	9415	12 (1,6)	47 (0,5)	<0,001
Fetal death, n/N2 (%) and n/N3 (%)	9302	8 (1,15)	8 (1,0)	0,758**
RIG[3], n/N2 (%) and n/N3 (%)	9434	51 (6,7)	208 (2,4)	<0,001**
Oligohydramnios, n n/N2 (%) and n/N3 (%)	9415	24 (3,2)	175 (2)	0,003**
Prenatal of origin, another city n/N2 (%) and n/N3 (%)	11027	105 (13,8)	1024 (10,0)	0,001**

Legend: N1 = total sample of valid data; N2 = total sample of hypertensive patients; N3 = total sample of non-hypertensive patients, n = sample of patients with the evaluated characteristic. RIG: restricted intrauterine growth. CTG: cardiotocography. IQR = interquartile range. GA = Gestational age, ICU: intensive care unit. [1]Drug addiction: use of IIQ: interquartile range. 1Drug addiction: use of legal and illicit drugs. [2]Platectopenia: platelets<100,000/mm3. [3]IUGR: intrauterine growth restriction due to prenatal diagnosis. [4]Labor conduction analgesia: regional analgesia (epidural or spinal anesthesia). Student t-test*, chi-square test**, Mann-Whitney test***.

We registered a single case of maternal death, which occurred due to the postpartum transfer of a patient in a serious condition to the ICC of our service. We understand that the approach to pregnant women with installed hypertension requires protocol strategies and adequate lines of care.

The creation of the group called "Hypertension in pregnancy" was a strategy used for the statistical analysis of all hypertensive conditions, since the data records occurred by the codification of ICD-10. Pregnant women are classified and entered at the time of admission, and at hospital discharge the data on delivery are entered, maternal and newborn outcomes are entered. This form of recording made isolated studies of pre-eclampsia in its pure form unfeasible. It is worth mentioning the impossibility of reclassifying the pregnant woman during hospitalization, which strengthens the reliability of the information concerning the maternal and fetal outcome but does not allow the reclassification of the forms of hypertensive disease.

The variable clinical or electronic fetal monitoring during labor was recorded in 10,125 births, which is equivalent to 90.6% of cases and almost 10% of data were not recorded. 74.5% of pregnant women with hypertension during pregnancy and 76.9% of normotensive pregnant women were monitored with Doppler sonar and Pinard stethoscope. The other pregnant women were electronically monitored by intrapartum cardiotocography, totaling 2,356 deliveries and 25% of deliveries in the control group. We believe that the high percentage of newborns who required a neonatal unit and intrapartum cardiotocography in the control group is due to other maternal comorbidities that are not the focus of this study, because the maternity of the study is quaternary and of high obstetric risk.

Regarding newborns, a total of 11,397 births were recorded, of which 1,857 were born prematurely, with a higher frequency (39.9%) in the group of pregnant women who have developed hypertension during pregnancy. Other complications such as growth restriction, small for

Table 2. Characteristics of birth care and maternal complications

	Valid datta (N[1] = 11173)	**Present hypertension** (N[2]= 754)	**Absent hypertension** (N[3] = 10409)	p
GA at birth (weeks), mean (SD)	11173	37,3 (4,0)	39 (2,1)	<0,001*
Prematurity, n/N2 (%) and n/N3 (%)	11124	303 (39,9)	1554 (15,0)	<0,001**
Conduct analgesia [4], n/N2 (%) and n/N3 (%)	10414	79 (11,4)	2353 (24)	<0,001**
Fetal monitoring	7769			0,164**
Clinical monitoring, n/N2 (%) and n/N3 (%)		505 (74,5)	7264 (76,9)	
Intermittent CTG, n/N2 (%) and n/N3 (%)		173 (25,5)	2183 (23,1)	
Continuous CTG, n/N2 (%) and n/N3 (%)		17 (2,5)	160 (1,7)	
Cesarean delivery, n/N2 (%) and n/N3 (%)	10269	489 (71,3)	3263 (33,8)	<0,001**
Near miss, n/N2 (%) and n/N3 (%)	6267	49 (9,5)	155 (2,7)	<0,001**
Hemorrhage, n/N2 (%) and n/N3 (%)	10414	40 (5,8)	293 (3,0)	<0,001**
Blood transfusion, n/N2 (%) and n/N3 (%)	6267	28 (5,4)	125 (2,2)	<0,001**
ICU admission, n/N2 (%) and n/N3 (%)	10964	29 (5,6)	48 (0,8)	<0,001**

Legend: N1 = total sample of valid data; N2: total sample of hypertensive patients; N3 = total sample of non-hypertensive patients, n = sample of patients with the evaluated characteristic. CTG = cardiotocography. GA = Gestational Age, ICU: intensive care unit. [1]Postpartum hemorrhage = estimated loss of more than 500 mL in vaginal birth and 1000 mL in cesarean section. Student t-test*, Chi-square test **, Mann-Whitney test***.

gestational age newborn, oligohydramnios, and APGAR of the 1st and 5th minute showed worse results in women with hypertension in pregnancy. Valid data for intrauterine growth restriction analysis (IUGR) were recorded in 9,434 deliveries. Of these, 259 fetuses presented IUGR with more cases in the hypertensive group (p<0.01). A fetus with growth below the 10th percentile was considered to be IUGR, according to the current classification at the time of the study. The rates of cesarean section and the presence of oligohydramnios were also higher. Growth restriction and oligohydramnios are conditions frequently associated with placental hypertension dysfunction in pregnancy (pre-eclampsia and chronic arterial hypertension[24]). As a limitation of the study, data of interest, such as the need for resuscitation of newborns in the delivery room, were not variables recorded during the study period.

Thirty-five percent of the newborns were referred from the delivery room to the neonatal unit, and death occurred in both groups, 15 (2.15%) in the group of pregnant women with hypertension and 185 (1.9%) in the normotensive group. This difference was not significant and may reflect the quality of neonatal care provided in a high-complexity maternity hospital.

Database studies are relevant to analyze large numbers of cases at times of interest. Our study of data on hypertension in pregnancy and maternal and perinatal outcomes from SISMATER involves a significant number of pregnant women, and it probably truthfully reflects the reality of cases conducted at the service.

The moment of the study was selected after the creation of the database and before the SARS-CoV-2 pandemic to reduce selection bias. A systematic review on maternal and perinatal outcomes of coronavirus spectrum infections, and especially coronavirus disease of 2019 (COVID-19), showed that there are many complications in this period: pre-eclampsia occurred in 16% of infected pregnant women, prematurity due to premature rupture of membranes in 20.7% and growth restriction in 11.7% of the studied cases[28].

Limitations occurred and were a warning for adding new variables to the database and for new studies on hypertension and other conditions related to pregnancy. We were unable, for example, to obtain epidemiological data on pregnant women who were chronically hypertensive and had pre-eclampsia in a previous pregnancy. It was also not possible to know data of interest, such as the use of ASA in prenatal care for the prophylaxis of severe cases of pre-eclampsia. In our prenatal service, it is a routine protocol to introduce ASA between 12 and 36 weeks of pregnancy for all pregnant women at risk of pre-eclampsia. In the SISMATER database, there is a variable that identifies the origin of prenatal care, whether performed in a large center or not, but there is no specification of the prenatal care origin center. This fact limited the analysis of the impact of ASA in our prenatal care. On the other hand, it was evident the appropriate approach to the hypertensive conditions of pregnancy in our maternity hospital due to the reduced number of maternal and perinatal fatal outcomes.

Table 3. Immediate neonatal outcome in women with hypertension in pregnancy compared to non-hypertensive women (n=11387).

	Valid datta (N[1] = 11173)	**Present hypertension** (N[2]= 754)	**Absent hypertension** (N[3] = 10409)	p
Birth condition, n/N (%)	11.139			0,088**
Born alive, n/N (%)		658 (98,2)	10481 (98,1)	
Stillborn, n/N (%)		14 (1,8)	200 (1,9)	
Birth weight (grams), mean (SD)	11171	2595 (850)	2999 (636)	<0,001**
Weight/GA relation (WHO)	8.808			<0,001**
AGA, n/N (%)		468 (76,0)	6667 (81,55)	
SGA, n/N (%)		145 (21,9)	951(11,6)	
BGA, n/N (%)		50 (7,5)	(6,9)	
APGAR 1 min, median (IQR)	11074	8 (2)	8 (1)	<0,001**
APGAR 5 min, median (IQR)	11076	9 (0)	9 (1)	<0,001**
Newborn transfer after delivery room	10719			<0,001**
Joint accommodation, n/N (%)		458 (63,0)	10292 (82,8)	
Neonatal unit, n/N (%)		185 (35,0)	860 (15,3)	
Death, n/N (%)		15 (2,15)	185 (1,9)	

Legend: N1 = total sample of valid data; N2 = total sample of hypertensive patients; N3 = total sample of non-hypertensive patients, n = sample of patients with the evaluated characteristics. IIQ = interquartile range. AGA = appropriate for gestational age. SGA = small for gestational age, LGA = large for gestational age, according to Intergrowth 21st curve [ref]. Chi-square test**.

Conclusions

The information obtained from this study helps to guide internal protocols, analyze the behavior of the care team and serve as a basis for comparison with other hospital centers that deal with hypertensive syndromes in pregnancy. Besides that, keeping electronic health database active helps obtain information quickly. This study shows the great potential for complications for the pregnant/concept binomial resulting from hypertensive diseases in the period before the SARS-CoV-2 pandemic, and it serves as a basis for evaluating the impact of the pre-eclampsia/COVID-19 relation after the publication of this study. Improvements in health services are needed, especially with regard to integration between prenatal care and birth assistance for pregnant women, as well as access to a team qualified to deal with obstetric emergencies. It is recommended to increase attention focused on situations that pose a risk to pregnancy, with prevention and family planning measures being essential.

Author's contribution

We describe contributions to the papers using the taxonomy (CRediT):

Conceptualization, Formal Analysis, Methodology, Project Administration, Writing – Original Draft, Writing – Review & Editing: Patrícia Gonçalves Teixeira; *Conceptualization, Formal Analysis, Methodology, Project Administration, Resources, Supervision, Visualization, Writing – Original Draft, Writing – Review & Editing:* Eura Martins Lage; *Conceptualization, Formal Analysis, Resources, Supervision, Visualization, Writing – Original Draft, Writing – Review & Editing:* Mário Dias Corrêa Júnior; *Conceptualization, Investigation, Resources, Writing – Original Draft:* Marina Ribeiro Bartholo; *Conceptualization, Investigation, Resources, Writing – Original Draft: Anna Luiza Rocha Queiroz; Conceptualization, Investigation, Resources, Writing – Original Draft:* Lorena Almeida Silva; *Conceptualization, Formal Analysis, Methodology, Project Administration, Resources,*

Supervision, Visualization, Writing – Original Draft, Writing – Review & Editing: Zilma Silveira Noqueira Reis.

Copyright

References

1. Leal LF, Malta DC, Souza MFM, Vasconcelos AMN, Teixeira RA, Veloso GA, et al. Maternal Mortality in Brazil, 1990 to 2019: a systematic analysis of the Global Burden of Disease Study 2019. Rev Soc Bras Med Trop. 2022 Jan 28;55(Suppl 1):e0279. DOI: https://doi.org/10.1590/0037-8682-0279-2021.
2. World Health Organization (WHO). Maternal mortality. Global Causes of Maternal Death: A WHO Systematic Analysis. Geneva: WHO; 2019 Sep; [access in 2022 Sep 23]. Available from: https://www.who.int/news-room/fact-sheets/detail/maternal-mortality.
3. Sibai B, Dekker G, Kupferminc M. Pre-eclampsia. Lancet. 2005;365(9461):785-99. DOI: https://doi.org/10.1016/S0140-6736(05)17987-2.
4. Rana S, Lemoine E, Granger JP, Karumanchi SA. Preeclampsia: Pathophysiology, Challenges, and Perspectives. Circ Res. 2019 Mar 29;124(7):1094-112. DOI: https://doi.org/10.1161/CIRCRESAHA.118.313276.
5. Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on Hypertension in Pregnancy. Obstet Gynecol. 2013 Nov;122(5):1122-31. DOI: https://doi.org/10.1097/01.AOG.0000437382.03963.88.
6. Henderson JT, Thompson JH, Burda BU, Cantor A. Preeclampsia Screening: Evidence Report and Systematic Review for the US Preventive Services Task Force. JAMA. 2017 Apr 25;317(16):1668-83. DOI: https://doi.org/10.1001/jama.2016.18315.
7. Morse ML, Fonseca SC, Barbosa MD, Calil MB, Eyer FPC. Mortalidade Materna no Brasil: O que mostra a produção científica nos últimos 30 anos? Cad Saúde Pública, Rio de Janeiro [Internet]. 2011; [cited 2022 Set 23]; 27 (4):623-38. Disponível em: www.scielo.br/j/csp/a/R4VnMBKz9d4f5Jp9bF6Pxzr/?format=pdf&lang=pt.
8. Peraçoli JC, Costa ML, Cavalli RC, de Oliveira LG, Korkes HA, Ramos JGL, et al. Pré-eclâmpsia – Protocolo 2023. Rede Brasileira de Estudos sobre Hipertensão na Gravidez (RBEHG); 2023.
9. Magee LA, Pels A, Helewa M, Rey E, von Dadelszen P; Canadian Hypertensive Disorders of Pregnancy (HDP) Working Group. Diagnosis, evaluation, and management of the hypertensive disorders of pregnancy. Pregnancy Hypertens. 2014 Apr;4(2):105-45. DOI: https://doi.org/10.1016/j.preghy.2014.01.003.
10. Peraçoli JC, Borges VTM, Ramos JGL, Cavalli RC, Costa SHAM, Oliveira LG, et al. Pre-eclampsia/Eclampsia. Rev Bras Ginecol Obstet. 2019 May;41(5):e1-e2. DOI: https://doi.org/10.1055/s-0040-1702167.
11. Rana S, Karumanchi SA, Lindheimer MD. Angiogenic factors in diagnosis, management, and research in preeclampsia. Hypertension. 2014 Feb;63(2):198-202. DOI: https://doi.org/10.1161/HYPERTENSIONAHA.113.02293.
12. Jim B, Karumanchi SA. Preeclampsia: Pathogenesis, Prevention, and Long-Term Complications. Semin Nephrol. 2017 Jul;37(4):386-97. DOI: https://doi.org/10.1016/j.semnephrol.2017.05.011.
13. World Health Organization (WHO). Recommendations for Prevention and Treatment of Pre-Eclampsia and Eclampsia. Geneva: WHO; 2011.
14. Catov JM, Ness RB, Kip KE, Olsen J. Risk of early or severe pre-eclampsia related to pre-existing conditions. Int J Epidemiol. 2007 Apr;36(2):412-9. DOI: https://doi.org/10.1093/ije/dyl271.
15. von Dadelszen P, Menzies JM, Payne B, Magee LA; PIERS (Pre-eclampsia Integrated Estimate of RiSk) Study Group. Predicting adverse outcomes in women with severe pre-eclampsia. Semin Perinatol. 2009 Jun;33(3):152-7. DOI: https://doi.org/10.1053/j.semperi.2009.02.009.
16. Poon LC, Wright D, Rolnik DL, Syngelaki A, Delgado JL, Tsokaki T, et al. Aspirin for Evidence-Based Preeclampsia Prevention trial: effect of aspirin in prevention of preterm preeclampsia in subgroups of women according to their characteristics and medical and obstetrical history. Am J Obstet Gynecol. 2017 Nov;217(5):585.e1-e5. DOI: https://doi.org/10.1016/j.ajog.2017.07.038.
17. American College of Obstetricians and Gynecologists (ACOG). ACOG Committee Opinion No. 743: Low-Dose Aspirin Use During Pregnancy. Obstet Gynecol. 2018 Jul;132(1):e44-e52. DOI: https://doi.org/10.1097/AOG.0000000000002708.
18. World Health Organization (WHO). WHO recommendation: Calcium supplementation during pregnancy for the prevention of pre-eclampsia and its complications. Geneva: WHO; 2018.
19. Zakiyah N, Postma MJ, Baker PN, van Asselt AD; IMPROvED Consortium. Pre-eclampsia Diagnosis and Treatment Options: A Review of Published Economic Assessments. Pharmacoeconomics. 2015 Oct;33(10):1069-82. DOI: https://doi.org/10.1007/s40273-015-0291-x.
20. Till SR, Everetts D, Haas DM. Incentives for increasing prenatal care use by women in order to improve maternal and neonatal outcomes. Cochrane Database Syst Rev. 2015 Dec 15;2015(12):CD009916. DOI: https://doi.org/10.1002/14651858.CD009916.pub2.
21. Brown MA, Magee LA, Kenny LC, Karumanchi SA, McCarthy FP, Saito S, et al. Hypertensive Disorders of Pregnancy: ISSHP Classification, Diagnosis, and Management Recommendations for International Practice. Hypertension. 2018 Jul;72(1):24-43. DOI: https://doi.org/10.1161/HYPERTENSIONAHA.117.10803.

22. Umesawa M, Kobashi G. Epidemiology of hypertensive disorders in pregnancy: prevalence, risk factors, predictors and prognosis. Hypertens Res. 2017 Mar;40(3):213-20. DOI: https://doi.org/10.1038/hr.2016.126.

23. Einav S, Leone M. Epidemiology of obstetric critical illness. Int J Obstet Anesth. 2019 Nov;40:128-39. DOI: https://doi.org/10.1016/j.ijoa.2019.05.010.

24. Gagnon R. Placental insufficiency and its consequences. Eur J Obstet Gynecol Reprod Biol. 2003 Sep 22;110(Suppl 1):S99-107. DOI: https://doi.org/10.1016/s0301-2115(03)00179-9.

25. Garcia EM, Candelorio AP, Pelloso SM, Antunes MB. Perfil e resultados perinatais de gestantes com síndrome hipertensiva do Sul do Brasil. Saúde Coletiva (Barueri) [Internet]. 2020; [cited 2024 Jan 20]; 10(53):2450-9. Disponível em: https://revistasaudecoletiva.com.br/index.php/saudecoletiva/article/view/589.

26. Bramham K, Parnell B, Nelson-Piercy C, Seed PT, Poston L, Chappell LC. Chronic hypertension and pregnancy outcomes: systematic review and meta-analysis. BMJ. 2014;348:g2301.

27. Panaitescu AM, Baschat AA, Akolekar R, Syngelaki A, Nicolaides KH. Association of chronic hypertension with birth of small-for-gestational-age neonate. Ultrasound Obstet Gynecol. 2017;50(3):361-6.

28. Di Mascio D, Khalil A, Saccone G, Rizzo G, Buca D, Liberati M, et al. Outcome of coronavirus spectrum infections (SARS, MERS, COVID-19) during pregnancy: a systematic review and meta-analysis. Am J Obstet Gynecol MFM. 2020 May;2(2):100107. DOI: https://doi.org/10.1016/j.ajogmf.2020.100107.