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Evaluation of the complete blood count and sociodemographic data as a strategy to reduce early interruptions of pregnancies

Avaliação do hemograma completo e dados sociodemográficos como estratégia da redução das interrupções precoces de gestações

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A B S T R A C T

Objective: To verify what were the main predisposing factors for early interruptions of pregnancy before and during the Covid-19 pandemic found in the analyses of the complete blood count. **Methods:** This observational study was carried out in a university maternity hospital located in the city of São Luís, MA. Data collection took place in the first half of 2018 and 2020, and the blood counts, sociodemographic and obstetric profile of the postpartum women and the neonatal profile of the newborns of these women were analyzed. **Results:** 133 women were included in the study. Hemoglobin values were correlated with newborn weight; platelets with gestational age and length of hospital stay, and that the main cause of early termination of pregnancy was associated with complications of the cardiovascular system. **Conclusions:** The main interruptions of pregnancies before and during the Covid-19 pandemic occurred mainly due to cardiovascular complications evidenced by predisposing factors such as plateletsis, anemia and vascular resistance, situations that are evidenced in the complete blood count and that, although prenatal care is well planned, can favor better prognosis in cases of laboratory abnormalities.

R E S U M O

Objetivo: verificar quais foram os principais fatores predisponentes das interrupções precoces da gestação antes e durante a pandemia da Covid-19 encontrados nas análises do hemograma completo. **Métodos:** estudo observacional realizado numa maternidade universitária, situada no município de São Luís, MA. A coleta dos dados ocorreu no primeiro semestre dos anos de 2018 e 2020, foram analisados os hemogramas, perfil sociodemográficos e obstétricos das puérperas e perfil neonatal dos recém-nascidos dessas mulheres. **Resultados:** foram incluídas no estudo 133 mulheres. Verificou-se correlação dos valores de hemoglobina com o peso do recém-nascido; das plaquetas com idade gestacional e tempo de internação, e que a principal causa de interrupção precoce da gestação foi associada a complicações do sistema cardiovascular. **Conclusões:** as principais interrupções das gestações antes e durante a

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pandemia da Covid-19 ocorreram principalmente por complicações cardiovasculares evidenciadas pelos fatores predisponentes como plaquetose, anemia e resistência vascular, situações essas que são evidenciadas no hemograma completo e que se bem o pré-natal for bem planejamento pode favorecer melhores prognósticos em casos de alterações laboratoriais.

Introduction

Maternal physiology adapts to the changes of pregnancy involving cardiorespiratory and glycometabolic changes, these basic maternal physiological adaptations necessary to have a healthy fetus and newborn remained the same; the growing fetus always needs sufficient oxygen and substrates for rapid development and growth, euthermic environment and efficient removal of by-products[1]. However, environmental interference can result in the development of hypertension, obesity, diabetes, restricted intrauterine growth of the fetus, among other circumstances, and it is necessary to act as soon as possible to restore physiological balance or minimize risks.

Environmental influences are capable of generating triggers for stress and interfering in the development of systems with high plasticity, such as the cardiovascular system, the digestive system, the immune system and the central nervous system[2] of both women and children in development[3]. The new coronavirus pandemic has been described as a stress inducer for the global population[4], in addition to patient reports about the increase in anxieties, it has been observed that psychological stress can activate mast cells, cytokine storms and neuroinflammation[5].

In addition, it has been described in previous studies that maternal stress can trigger premature births[6], fetal suffering and malformations, and low birth weight[7]. In addition to reports of neurodevelopmental impairment, low cognitive development, negative affectivity, difficult temperament and psychiatric disorders in the offspring[8].

In this scenario, an increase in pregnancy interruptions associated with injuries caused by the SARS-CoV-2 pandemic was observed[9]. The social and economic impact of the Covid-19 pandemic over the years is uncertain, but it is known that health outcomes will be better in countries that have made the most efforts to develop health systems that result in successful control of chronic, infectious, maternal, and neonatal diseases[10].

Associated with this, it was also found that, according to data from the Global Burden of Disease (2019)[11], the main causes of health loss for both sexes are primarily related to neonatal diseases, while the main risks associated with the number of deaths for women, of all ages, worldwide, are associated with decompensation of some chronic disease such as hypertension, obesity and diabetes[11]. Thus, this study was based on the following guiding question of the study: What is the relationship between these early interruptions of pregnancies and alterations in the complete blood count and with sociodemographic data?

This study was justified by the fact that identifying the main causes for early termination of pregnancy based on the analysis of the complete blood count in order to collaborate with the adoption of new approaches in prenatal care at usual risk, as this service is the main gateway for pregnant women.

Objective

To verify what were the main predisposing factors for early interruptions of pregnancy before and during the Covid-19 pandemic found in the analyses of the complete blood count.

Methods

Ethical aspects

The study complied with the ethical precepts of Resolution 466/2012 of the National Health Council, and the project was approved by the Institutional Research Ethics Committee (Opinions No. 3,301,629/2018; No. 4,310,608/2020 and No. 4,354,594/2020).

Study design, period, and location

This is a survey-type study, with exploratory and descriptive purposes, based on an observational approach, with a cross-sectional design. To guide the study, the guidelines of the form of observational studies in Epidemiology (STROBE) were adopted. The data were collected in two periods, the first from March 3rd to June 30th, 2018 when it was still in the research phase of the master's degree and the second from March 3rd to June 30th, 2020, already in the research of the doctoral program, for this purpose an addendum to the research project that was previously approved was inserted to restructure the schedule. Postpartum women who were hospitalized in the Rooming-in and Intensive Care Unit of the University Hospital of the Federal University of Maranhão (*Hospital Universitário da Universidade Federal do Maranhão* - HUUFMA) during data collection participated in this research.

The time lapse was defined based on the need to continue the research to compare the data in different years between people with the same pre-defined variables. We sought to verify and compare the sociodemographic, hematological and immunological profile of pregnant women, puerperal women and neonates, it should be noted that during the second collection period the pandemic was decreed, an event of great socio-environmental injury,

the three numbers of opinions approved by the ethics committee are justified by the addendums that were necessary to the project during the research.

Population or sample; inclusion and exclusion criteria

The target population was postpartum women who had their pregnancies interrupted early. They were invited to participate in the research in a personal and direct way, those who accepted signed the Term of Free and Informed Commitment (TFIC), even those who had been with children hospitalized in the Neonatal Intensive Care Unit participated after signing and agreeing to the terms of the TFIC. Respect for Law No. 13,709/2018[12], which deals with the protection of personal data, was guaranteed.

The sample was obtained by convenience. Women admitted to the maternity ward of the University Hospital of Maranhão (*Hospital Universitário do Maranhão*) due to indication of pregnancy interruption with gestational age prior to 37 weeks were included in the study, other inclusion criteria were: Mothers aged 12 years or older; eutrophic; with negative serological reactions to hepatitis, HIV, syphilis; pregnancy and delivery without twins, without fetal malformations. Those who had indications and full-term labor were not included in the study.

After accepting to participate in the research, the data were collected from medical records. The variables pertinent to the sociodemographic factors refer to age, education, marital status, type of prenatal care, place of prenatal care, type of delivery, length of hospitalization, gestational age, weight of the neonate, number of pregnancies, associated comorbidities, and hospitalization outcome.

As for the variables found in the laboratory tests, the individual results of hemoglobin, erythrocytes, lymphocytes and platelets were analyzed, it is noteworthy that the tests were collected by the technicians of the hospital laboratory who follow a standard procedure of the institution, the results of these tests were printed in two copies, one was in the medical record and the other constituted the research files for database maintenance. The results of the exams and the sociodemographic profile were compared between the years to verify the distribution and possible differences between women in 2018 and 2020. The delivery room records of the newborns born to the women included in the research were also evaluated, as well as the tests that were collected from them based on the collection of information also from the medical records.

Study protocol

The method of selection of the participants was based on non-probabilistic characteristics, with selection based on similarity, the information related to the sociodemographic data of the participants and the newborns were obtained through consultations in the medical records, in the direct interview carried out due to the need to explain the research and request participation with signature of the TFIC. After this stage, data found in the medical records were collected in search of answers from a structured checklist with open and closed questions.

Analysis of results and statistics

The data were recorded with double entry, by the researchers themselves, in an electronic data spreadsheet (Microsoft Excel). The information was exported to the GraphPad Prism 8 software. Data analysis was performed using descriptive statistics, using frequency tables and calculation of position measures (average, minimum and maximum). The analysis of the normality of the quantitative variables was performed using the Shapiro-wilk test. In addition, Pearson's test was used to evaluate the correlations between the data (the qualitative data were standardized into numbers so that the analysis could be performed). The Student's t-test evaluated the comparisons between two groups and, when it was used for categorical variables, the data were first standardized in numbers so that it was possible to perform statistical analysis from this test; in addition, ANOVA was used when the comparisons were for more than two groups. In all results, the value of $p < 0.05$ was considered significant.

Results

133 women who were in the immediate postpartum period participated in the research, 72 in 2018 and 61 during 2020. Of these women, most were between 21 and 30 years old, attended high school, most were single women, were hospitalized for a period of more than three and less than 15 days, although most of them came from habitual risk prenatal care (Table 1).

Table 1.
Sociodemographic and obstetric variables found in the years 2018 and 2020, São Luís, MA, Brazil.

Variables	2018 Cases (n=72)		2020 Cases (n=61)		
	Results N x f%	IC 95%	Results N x f%	IC 95%	p value

Age (in years)		27.04 - 30.39	26.42 - 29.51	0.5129
≤ 20	10 (14)	4 (6)		
21 – 35	49 (68)	45 (74)		
36 – 40	12 (17)	8 (14)		
≥ 41	1 (1)	4 (6)		
Education		41.22 - 47.11	29.13 - 34.46	0.0736
Elementary Education	8 (11)	15 (25)		
High School	51 (72)	33 (54)		
Superior	12 (17)	13 (21)		
Marital status		14.21 - 17.86	4.06 - 15.57	0.0879
Married/stable union	15 (21)	21 (34)		
Single	57 (79)	40 (66)		
Type of prenatal care		3.98 - 7.90	1.40 - 4.27	**0.0414**
Usual risk	54 (75)	56 (91)		
High risk	19 (25)	6 (9)		
Type of childbirth		12.40 - 17.85	1.03 - 3.46	**0.0001**
Vaginal	9 (12,5)	4 (6)		
Caesarean	63 (87,5)	57 (94)		
Time of hospital stay		13.98 - 17.68	8.07 - 14.50	**0.0123**
≤ 3	2 (3)	8 (13)		
4-15	54 (75)	28 (45)		
≥ 16	16 (22)	26 (42)		
Gestational age		22.30 - 29.32	27.67 - 32.21	**0.0001**
Preterm	44 (61)	52 (85)		
In term	26 (36)	10 (15)		
Post-term	2 (3)	0		

Note: Student's T-Test.

The hematological parameters were analyzed from the verification of the results of part of the blood count variables, it was observed that the cells that make up the white series of the blood tissue had lower values in 2020 among the puerperal women who participated in the study, as shown in Table 2.

Table 2.

Mean results found in women's blood counts in 2018 and 2020, São Luís, MA, Brazil.

Variables	2018	2020	P value[a]
Hemoglobin	11.24	11,16	0.7635
Erythrocytes	4.877	3.915	0.3064
Leukocytes	12060	9402	**0.0008**
Lymphocytes	2218	1664	**0.0016**
Platelets	221447	245083	0.4979

Note: Student's T-Test.

With the results of tables 1 and 2, it was identified that the length of hospitalization was related to the amount of lymphocytes released in the postpartum period, in addition, platelet values were correlated with gestational age and with the type of comorbidity that resulted from the interruption of pregnancy, as well as we identified a correlation between the mother's hemoglobin values and the newborn's weight, positive correlation, the lower the hemoglobin values, the lower the newborn's weight (Table 3).

As for the main causes of pregnancy interruptions, in 2018 the main cause was associated with preeclampsia and in 2020 the associations of decompensation of pressure values such as hypertension, preeclampsia and/or Pregnancy-Specific Hypertensive Syndrome (SHEG) prevailed, however, there was a significant increase in deliveries that were interrupted by fetal centralization and placental abruption, in addition to the registration of two maternal deaths in the same year (Table 3).

Table 3.

Causes of pregnancy interruptions in the years 2018 and 2020.

Some Causes of Interrupted Pregnancies	**2018 Cases (n=72) n (f%)**	**2020 Cases (n= 61) n (f%)**
Amniorrex	0 (0)	1 (1.6)
Asthma	4 (5.5)	0 (0)
Bypass	1 (1.4)	0 (0)
Fetal centralization	1(1.4)	**15 (25)**
Complications related to Covid-19	0 (0)	2 (3.2)
Placental abruption	2 (2.8)	**6 (9.8)**
Diabetes	**9 (12)**	**6 (9.8)**
Gestational Hypertensive Disease	4 (5.5)	**6 (9.8)**
Epilepsy	2 (2.8)	1 (1.6)
Hypertension	**7 (9.7)**	**10 (16.4)**
Urinary Tract Infection (UTI)	2 (2.8)	1 (1.6)
Preeclampsia	**40 (55)**	**10 (16.4)**
Thrombophilia	0 (0)	3 (5)
Admissions sector		
Rooming-in	72 (100)	55 (90.2)
ICU	0 (0)	**6 (9.8)**
Hospitalization outcomes		
Discharge due to cure or improvement	72 (100)	59 (97)
Death	0 (0)	**2 (3)**

Note: Student's T-Test.

Because the blood count is a consolidated test in clinical practice, it was the option of choice as an evaluation parameter, based on the analyses it was possible to identify that there is a positive correlation between longer hospital stay and lymphocyte count. There was also a

positive correlation between platelet counts and gestational age and between maternal hemoglobin values and newborn weight (Table 4).

Table 4.

Correlation of laboratory parameters with the obstetric characteristics of the mother, São Luís, MA, Brazil.

Variables	Hemoglobin		Leukocytes		Lymphocytes		Platelets	
	r[a]	*P*[b]	r	*p*	r	*p*	r	*p*
Type of comorbidity	0.091	0.150	0.115	0.376	0.138	0.103	0.104	**0.036***
Newborn weight	0.429	**0.007***	0.146	0.169	0.201	0.233	0.128	0.445
Gestational age	-0.017	0.116	0.089	0.477	0.216	0.103	0.274	**0.035***
Time of hospital stay	-0.158	0.227	0.176	0.232	0.400	**0.029***	0.164	0.211
Type of comorbidity	0.416	**0.001***	0.015	0.912	0.085	0.520	0.29	0.826
Newborn weight	-0.250	**0.054***	0.146	0.266	0.051	0.702	0.072	0.584
Gestational age	-0.165	0.518	0.148	0.189	0.043	0.746	0.074	0.576
Time of hospital stay	-0.031	0.518	-0.110	0.411	0.015	0.091	0.010	0.939

Note: Student's T-Test.

a: Pearson Correlation Coefficient.

b: P value.

(*) $p < 0,05$.

Discussion

Care for pregnant women must ensure a reduction in morbidity and mortality rates, for this it is necessary to know the obstetric and reproductive characteristics of women and from the situation detected, intervene with guidelines that contribute to the modification of risk precursors, it is worth remembering that prenatal care is often the first opportunity that health services have to address health issues with women and for communication to be effective, physiological issues must be addressed, behavioral, social, biomedical and psychological.[12]

Our results indicated that regarding the sociodemographic and obstetric profile of the 133 women investigated, most declared themselves single and were aged between 21 and 30 years, in this aspect researchers considered that such a scenario demonstrates the vulnerability of these patients, because the low level of education and the marital situation configured with a woman and child without a partner is based on aspects that involve the pregnant woman in unstable social situations and with greater insecurity in the cycle reproductive.[13]

In addition, we observed that the average length of hospital stay was up to 15 days, even though in most cases it was a public coming from habitual risk prenatal services, under this scenario, scholars associated[14] this indicator with greater anesthetic complications, accidents and puerperal infections, while others[13] emphasized that correct risk screening by basic professionals prevents complications that have contributed to the greater exposure of women to risks.

An important screening tool used in prenatal care is laboratory tests that allow the identification of numerous risk factors and direct pregnant women to specialized services as early as possible, the blood count, for example, guides to a situation of high prevalence that is anemia where scholars estimate that in the world this disease affects 41.8% of pregnant women and 30.2% of non-pregnant women, confirming vulnerability to anemia in the gestational period.[15]

It is also known that anemia is associated with low birth weight and increased risks of maternal and fetal morbidity and mortality due to hemorrhagic events[16], however, little has been associated with the development of preeclampsia, the first cause of maternal death,[17] in addition, it is known that preeclampsia increases hemolysis during pregnancy[18] However, another study[19] suggests that anemia actually dispenses with and increases the risks for the development of cardiovascular complications associated with hypertension.

Our analyses allowed us to identify that both in 2018 and 2020 the main causes of pregnancy interruption were correlated with cardiovascular complications resulting in preeclampsia and/or episodes of hypertension, it was also possible to identify that platelet values were correlated with gestational age and pregnancy interruptions, in this aspect a publication in the Lancet[20] suggests that the use of antiplatelet therapy reduces the risks of developing preeclampsia.

Another finding in our research was the significant increase in pregnancies interrupted by fetal centralization during 2020, which may be associated with Covid-19 infections that may have resulted in vascular complications due to increased platelet concentrations[21-22] and, consequently, decreased the quality of placental formation, which, in turn, also increases the risks of hypertensive complications, which is the main cause of maternal death[17; 23].

The progression of Covid-19 was associated with a process of coagulopathy, with a greater possibility of the development of disseminated intravascular clots (DIC) in the intervillous spaces of the placenta, due to the infection leading to a dysfunction of the intervillous epithelial cells that led to the release of platelet aggregation stimulators, affecting the gas and nutrient exchange between mother and fetus[24-25]. Other studies have found a strong correlation between increased plasma D-dimer and a worse prognosis of the disease.

The results show that people (including pregnant women) who died from the disease had D-Dimer dosages above the average of the survivor group[24-26].

The fact that the follow-up of the women included in this research occurred from labor and in the immediate puerperium was considered an important limitation of the study, this did not allow us to evaluate what preceded the comorbidities that resulted in the hospitalizations of the women investigated in the present study, a fact reported by researchers[26-27] in relation to the scenario during the Covid-19 pandemic was the fact that there were changes in the way of life and, in the health services themselves, with a reduction in the time of prenatal consultations and restriction of access to prenatal care, puerperal consultations and follow-up of newborns, in addition, the dynamics of childbirth follow-up have also undergone modifications and restrictions, such as the presence of the companion, which was restricted for a period[27].

Study Limitations

The limitations of data collection are considered to be the restriction of data collection to the rooming-in units, and it is not possible to generalize the results because data regarding prenatal care were not sufficiently collected, considering that contact with the women occurred only after hospitalization in the maternity hospital.

Contributions to the area of Nursing, Health or Public Policy

It is expected that the results of this study will support the early interpretation of possible complications based on the evaluation of laboratory tests, such as complete blood count, especially in prenatal care of the usual risk, with guidelines and conducts that may interfere with the increase in the risks verified both in the tests and in the sociodemographic profile of the woman attended during prenatal care.

Conclusions

This research raised important questions and evidences that can ensure higher quality of care during prenatal care, with rigorous observation of the results predicted in the blood count, which define the possibility of early interventions for better prognosis in the care of the mother/child binomial. Noting that primary care is the main gateway to access for pregnant women, it is suggested that the approach during prenatal care should emphasize a qualitative investigation of the data, associating the results of the tests with predictive risk factors and minimizing the impacts of morbidities associated with the gestational and puerperal period.

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