International Journal of Medical Science and Research
www.medicaljournals.in
Online ISSN: 2664-8768, Print ISSN: 2664-875X
Received: 23-10-2023, Accepted: 08-11-2023, Published: 25-11-2023
Volume 5, Issue 4, 2023, Page No. 29-32

Gestational hypertension during pregnancy: Evaluation of risk factors and correlation with clinical parameters in Aljala Maternity Hospital, Tripoli-Libya

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Abstract
Background: Gestational hypertension is one of the major disorders that affect the mother and fetus and is the major cause of maternal and prenatal morbidity worldwide. The purpose of this study was to investigate the general risk factors that have impact on the clinical outcome of pregnancy and to find the significant correlation between elevated blood pressure and determined laboratory parameters.
Materials & Methods: A total of 100 pregnant subjects with gestational hypertension complications from Aljala maternity hospital, Tripoli, Libya were included in this study. Age between 15-55 years (mean= 33, 4). Blood pressure was measured at the time of evaluation. All the necessary information regarding the risk factors that influence the pregnancy such as blood pressure, age, blood group, number of pregnancies, period of pregnancy were collected and documented in specific form. Different laboratory investigations were performed according to the standard protocol.
Results: older age was associated significantly with high blood pressure (p=0.005), also increased number of pregnancies was significantly correlated with elevated blood pressure (p=0.018). We found no significant relationship between gestational hypertension and type of blood group and period of pregnancy. White blood cell count, red blood cell count, hematocrit level, and uric acid concentration were significantly correlated with high blood pressure (p= 0.048, 0.041, 0.006, and0.030 respectively).
Conclusion: gestational hypertension was correlated with different risk factors such as old age, number of pregnancies and had impact on several laboratory parameters that can be used as predictive indicator of the pregnancy clinical outcome.

Keywords: Gestational hypertension, blood pressure, pregnancy, risk factors, laboratory parameters

Introduction

Hypertension is one of the most common medical complications during pregnancy, occurring in 10% of pregnancies and the leading cause of perinatal mortality and morbidity [1, 2]. Nearly 70 % of pregnant women that diagnosed with hypertension will have gestational hypertension-preeclampsia which can be further divided into mild elevation in blood pressure (BP), or severe hypertension with different organ dysfunction [3]. Few information is known about why some women with a primary gestational hypertension progress to Preeclampsia while others do not. Some of possible etiologies that may lead to preeclampsia include abnormal trophoblastic invasion of uterine blood vessels, dietary deficiencies and genetic abnormalities [4].

Gestational hypertension can be defined as a systolic BP of at least 140 mm Hg and /or a diastolic BP of at least 90 mm Hg on at least two occasions at least 6 hours apart after the 20th week of gestation in women known to be normotensive before pregnancy and before 20 weeks gestation [5].

Preeclampsia is considered as de novo hypertension that appear after twenty weeks of gestation and associated mainly with elevated blood pressure, significant proteinuria, and edema/or other maternal organ dysfunction such as renal dysfunction, liver disease, cerebral disease or coagulation abnormalities. Therefore, it is standard clinical practice to consider any pregnancy-related hypertension patient as an emerging pre-eclamptic case [6, 7].

Women with Pregnancy-induced hypertension are at a greater risk of abruption placentae, cerebrovascular events, organ failure and disseminated intravascular coagulation and fetuses are at greater risk of intrauterine growth retardation, prematurity and intrauterine death.

Gestational hypertension can be classified into: pregnancy - induced hypertension, chronic hypertension**,** Pregnancy - aggravated hypertension**,** and transient hypertension [8, 9].

The most common risk factors of Gestational hypertension include: age, obesity, first time pregnancy, family history, multiple pregnancies, and Preexisting medical conditions such as diabetes, kidney disease, or autoimmune disorders. Also Women who smoke, drink alcohol, are at a higher risk of Pregnancy-induced hypertension [10].

Understanding of the pathophysiology is growing; there is a general agreement that the placenta plays a crucial role in the pathophysiology of Preeclampsia. The complication of Pregnancy-induced hypertension include: Intravascular hemolysis, Proteinuria, Placenta abruption and fetal discomfort [11, 12].

Because the process of hypertensive disease begins long before signs and symptoms appear, different studies have tried to develop series of prediction tests. There are more than 100 clinical biochemical tests have been developed for predicting women at risk of preeclampsia. These tests should be with high sensitivity value, rapid, in expensive, and easy to perform early in pregnancy [13].

In addition to blood pressure, the more used clinical and biochemical investigations include: Roll-over test, detection

of higher uric acid levels, some specific inflammatory cytokines that released by leukocytes, elevated leukocyte level, elevated serum cellular fibronectin level, appearance of anti-phospholipid antibodies, Doppler velocity measurement, and some placental-Peptides such as the corticotropin-releasing hormone, chorionic gonadotropin, activin A, and inhibin A [14, 20].

This study aimed to evaluate the general risk factors that have impact on the pregnant women, and to investigate the relationship between them and the prevalence of gestational hypertension. Additionally, we will correlate between the gestational hypertension and different biochemical and immunological parameters and evaluate which parameters have a significant impact on the pregnancy outcome in our determined study cohort.

Materials and methods

Study design and setting

A cross-sectional study was conducted from May 2023 to August 2023 at Aljala maternity hospital, Tripoli, Libya.

A total of 100 samples were collected from pregnant women with gestational hypertension complications.

Inclusion criteria

Pregnant women who diagnosed with gestational hypertension (a systolic BP of at least 140 mm Hg and /or a diastolic BP of at least 90 mm Hg) of aged between 15-55 years were included in this study.

Exclusion criteria

1. Pregnant women with normal blood pressure values.
2. Pregnant women aged younger than 15 years or older than 55 years.
3. Subjects with limited number of analysis

Procedure methodology

After written informed consent was obtained, Fresh whole blood specimens were collected during the period of gestational hypertension. Patient‘s peripheral venous blood was collected into 10-ml heparin/EDTA vacationer tubes. Samples were tested according to the standard procedures. Whole blood was analysed automatically for complete blood count, liver and kidney function profiles. Laboratory results, date of analysis, patient’s age, number of pregnancy, clinical state of the patients, types of medications, and blood pressure values were collected and documented in specific form. Blood pressure was measured according to the medical standard protocols. Systolic blood pressure value (minimum=130, Maximum= 180, mean= 158±8). Diastolic blood pressure value (minimum=90, maximum=120, mean=109±8).

Medical instruments

Complete blood count was done using Sysmex-KX-2 1 N (Japan 2011), whereas, liver and function investigation tests were done using Cobas Integra 400 plus (Switzerland 2012).

Statistical analysis

Data was analyzed using the Statistical package for the Social Sciences (SPSS for windows, version 23.0). Data was presented using mean ± standard deviation. The indicators were considered statistically significant at $p \leq 0.05$. ANOVA analysis was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by Pearson Correlation test to find significant correlation between two continuous variables.

Results

1. Demographic characteristics of patients

As shown in figure 1. A total of 100 patients were included in this study, age ranged from 16 to 50 years (mean= 33, 4, median= 37).

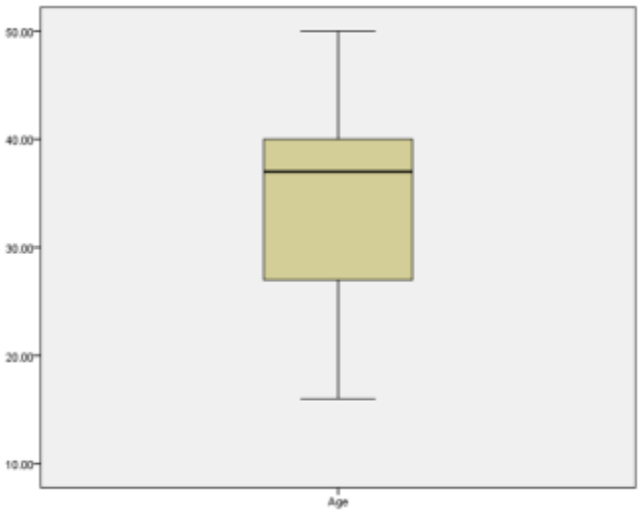

Fig 1: Mean of patients age

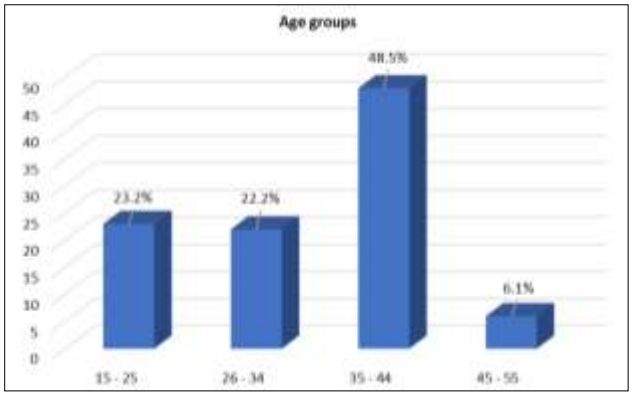

Fig 2: Percentages of patient's age

We also divided the patients according to their blood groups to correlate their gestational hypertension with blood groups (Fig.3).

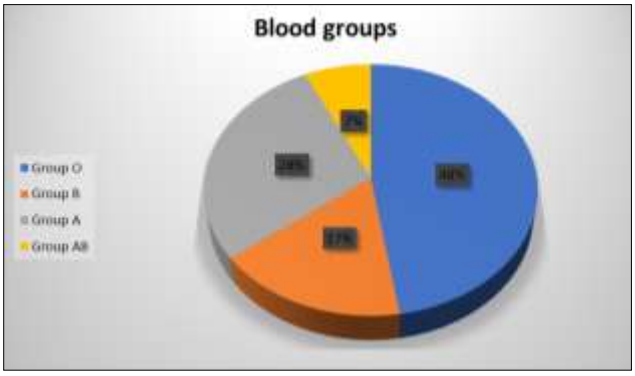

Fig 3: Percentages of patients' blood groups

To analyze the impact of the number of pregnancies on the clinical state of the pregnant and on the level of the blood pressure, we also divided the patients according to the number of pregnancies (Fig.4)

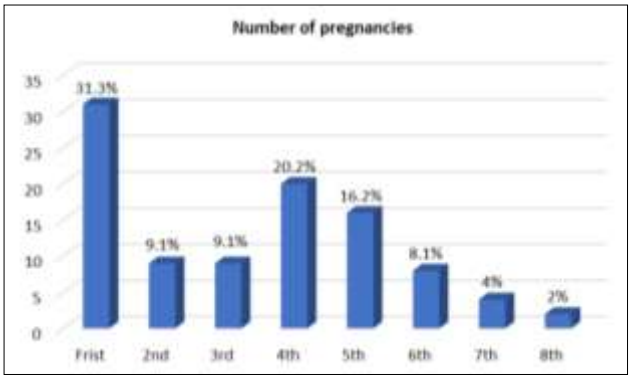

Fig 4: Percentages of number of pregnancies

Table 1: General factors that influencing blood pressure

Risk factors affecting blood pressure	P- value
Age	0.005
Blood groups	0.894
Number of pregnancies	0.018
Period of gestation	0.425

Correlation between the laboratory parameters and elevated Blood pressure

Table 2: Laboratory parameters that correlated with blood pressure

Parameter	Minimum	Maximum	Mean	Std. Deviation
WBC	4.60	***24.90***	12.1426	3.78000
RBC	2.00	9.80	4.0540	1.09022
HBG	2.85	32.00	10.5268	2.70770
HCT	22.20	44.80	32.5929	4.10496
PLT	87.00	448.00	215.5859	75.52078
Uric acid	3.03	8.70	5.4791	1.43540
ALP	46.20	298.00	147.4283	48.89492
ALT	3.00	32.00	12.7828	5.38905
AST	8.00	55.00	18.0242	7.81015
Creatinine	***0.20***	1.90	***0.6628***	30113***0.***
Urea	5.00	68.00	18.1030	9.01807

WBC=white blood cells, RBC= red blood cells, HGB= Hemoglobin, HCT= Hematocrit, PLT= Platelets, ALP=alkaline phosphatase, ALT= alanine aminotransferase, AST=aspartate aminotransferase

Table 3: Relationship between Laboratory parameters with high blood pressure

Laboratory parameters	P- value
White blood cells count	0.048
Red blood cell count	0.041
Hemoglobin level	0.650
Hematocrit level	0.006
Platelet count	0.158
Uric acid concentration	0.030
Alkaline phosphatase concentration	0.665
Alanine aminotransferase level	0.673
Aspartate aminotransferase level	0.230
Creatinine concentration	0.117
Urea concentration	0.571

Discussion

The present study was conducted to evaluate the most risk factors that play a role in gestational hypertension disorders and to correlate their impact on the determined laboratory parameters that used for monitoring the pregnant women.

Up on correlation with the age, our study suggested that older age was associated with elevated blood pressure values during pregnancy[21, 22].

As many previous reports, our findings have also found a significant relationship between number of pregnancies and increased risk of development of hypertension in pregnancy[23].

White blood cells (WBC) are regularly measured for the diagnosis of inflammations and infections during pregnancy. During first and second trimesters of pregnancy, elevated white blood cell counts had been detected and associated with increased risk of hypertension disorders[24,25].

Many different studies consistent with our results regarding the hematological changes during hypertension disorders, disorders in red blood cells count and hematocrit level had been determined[26,27].

Uric acid is generally increased in the blood of pregnant women with preeclampsia and can be used as an indicator to identifying perinatal risk in women with gestational hypertension because it is elevated before the presence of proteinuria and elevated blood pressure and therefore, it is used as a risk factor of increased fetal morbidity. Our results match with several studies that found a significant correlation between hyperuricemia and elevated blood pressure[28, 29].

While other studies had found correlation between liver and kidney function tests and elevated blood pressure, our results found no significant relationship between them in our study cohort. Additionally, our study suggested that no impact of blood group type or period of gestation on the occurrence of gestational hypertension.

Conclusion

This observational study found that there were several risk factors that associated with gestational hypertension complications in pregnant women such as older age, multiple pregnancies. Additionally, gestational hypertension disorders were associated with multiple effects on some laboratory parameters such as white blood cells count, erythrocytes count, hematocrit level, and uric acid concentration.

There were no information in subject's clinical files regarding many important data such as body weight, nutrition type, general health condition of pregnant women, viral and bacterial infections during pregnancy, and laboratory investigations such as inflammatory markers, cytokines profile, vitamins levels were also not provided. All these missing data had their limitation effects on our findings.

Acknowledement

I would like to express my special thanks of gratitude to my students Hamid Bashir Elgadi and Mustafa Ali Salem Elbarbar for their enthusiasm and efforts in collecting all clinical data.

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