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Efficacy of Low-Dose Aspirin in Preventing Preeclampsia in High-Risk Pregnancies

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ABSTRACT

Introduction: Preeclampsia is a major cause of illness and death for pregnant women and newborns worldwide, with an estimated prevalence ranging from 2% to 15% of all pregnancies, with an average of approximately 4.6%. **Objective:** The study's main objective is to find the efficacy of low-dose aspirin in preventing preeclampsia in high-risk pregnancies. **Methodology:** This randomized control trial was conducted at Shalamar Hospital, Lahore during 1st June 2024 to 31st Nov 2024. Data were collected from 165 pregnant women. Participants were randomly assigned into two groups: the aspirin group, which received a daily dose of 81 mg low-dose aspirin, and the placebo group, which received an identical-looking placebo. **Results:** Data were collected from 165 patients. Maternal age was 30.5 ± 4.2 years in the aspirin group and 31.0 ± 4.0 years in the placebo group ($p = 0.48$). Gestational age at enrolment averaged 13.8 ± 1.2 weeks and 13.7 ± 1.3 weeks for the aspirin and placebo groups, respectively ($p = 0.65$). BMI was 29.5 ± 3.8 kg/m² in the aspirin group and 29.8 ± 3.5 kg/m² in the placebo group ($p = 0.72$). Key risk factors, such as chronic hypertension (20% vs. 22%, $p = 0.76$) and history of preeclampsia (18% vs. 20%, $p = 0.68$), were evenly distributed. The mean gestational age at delivery was significantly higher in the aspirin group (38.2 ± 1.5 weeks) compared to the placebo group (36.8 ± 2.0 weeks). **Conclusion:** It is concluded that low-dose aspirin is an effective and safe intervention for preventing preeclampsia in high-risk pregnancies.

INTRODUCTION

Preeclampsia is a major cause of illness and death for pregnant women and newborns worldwide, with an estimated prevalence ranging from 2% to 15% of all pregnancies, with an average of approximately 4.6%. Complications of pre-eclampsia include coagulopathy, hepato-renal syndrome, cerebral hemorrhage and maternal death. Preeclampsia, which affects pregnancy only, is an independent cause of both maternal and perinatal morbidity and mortality across the globe [1]. Actual preeclampsia is mainly defined by developing hypertension and proteinuria after the second trimester combined with signs of involvement of other organs. The cause of preeclampsia has not been proven but the theories include; preeclampsia is because of the development of the placenta, maternal vascular endothelial dysfunction and mismatch of mother and fetus immunity [2]. There are certain risks associated with high risk pregnancy for such conditions; preeclampsia, multiple gestations, chronic hypertension, diabetes or obesity [3].

Procedures that should be taken to avoid preeclampsia is important as it has negative outcomes for both the mother and the baby. Of all the interventions being studied, the largest interest has been seen in the utilization of Low-Dose Aspirin (LDA) [4]. It has been believed that, like other antiplatelet agents, aspirin manages to interfere with some of the pathophysiologic processes behind preeclampsia, such as platelet aggregation, inflammation, and improper placentation. The antiplatelet and vasodilatory effect of aspirin induced by the inhibition of cyclooxygenase-1 (COX-1) and reduced production of thromboxane, a potent vasoconstrictor and platelet aggregator, enhances placental blood circulation [5]. Moreover, potential anti-inflammatory properties can improve endothelial dysfunction and oxidative stress, which are the central

pieces of preeclampsia mechanisms. In recent years, many randomized controlled trials and related meta-analysis have investigated the effects and safety of low-dose aspirin to alleviate preeclampsia [6]. The WHO and ACOG recommend low dose aspirin at 81-150 mg per day to women with conditions that put them at risk of preeclampsia, preferably before 16 weeks of pregnancy. Since aspirin therapy seems to be most effective in reducing the risk of preeclampsia and its complications when started early in pregnancy to coincide with the process of placentation, first trimester aspirin therapy represents the greatest benefit [7].

Despite being considered safe, low dose aspirin has to be taken with a measure of caution when taken during pregnancy. Side effects include gastrointestinal irritation or bleeding which are very rare but has to be balanced with the risks posed by preeclampsia. Furthermore, compliance and duration before initiation of aspirin regimen are core determinants in potent outcomes produced by aspirin [8]. To achieve the best results, it is crucial for healthcare taskers to timely recognize high-risk pregnancy utilizing risk-factor screening tools for maternal history and blood pressure, as well as biomarker profile assessment. Besides, the low dose aspirin has other benefits in improving pregnancy outcomes other than preventing preeclampsia. This has placed the intervention in a favourable light on risk reduction of preterm birth, fetal growth restriction and perinatal mortality [9]. The study's main objective is to find the efficacy of low-dose aspirin in preventing preeclampsia in high-risk pregnancies.

METHODOLOGY

This randomized control trial was conducted at Shalamar Hospital, Lahore during 1st June 2024 to 31st Nov 2024. Data Data were collected from 165 pregnant women.

Inclusion Criteria

Women aged 18–45 years, confirmed singleton or multiple pregnancies, and meeting high-risk criteria for preeclampsia.

Exclusion Criteria

Known allergies to aspirin, history of bleeding disorders, active gastrointestinal ulcers, or contraindications to antiplatelet therapy.

Data Collection

Participants were randomly assigned into two groups: the aspirin group, which received a daily dose of 81 mg low-dose aspirin, and the placebo group, which received an identical-looking placebo. This work was conducted between 12-16 weeks of gestation and followed up until either delivery or 36 weeks of gestation. Each of these participants had routine antenatal visits in which their blood pressure, proteinuria and other clinical indices were assessed. Systolic and diastolic blood pressures were recorded on an automated device at all visits and urine samples were tested for proteinuria. Use of aspirin or the placebo was assessed through counting of the remaining pills and patient's records of compliance. This kept giving room for early detection of any signs of preeclampsia or side effect from the intervention offered to the patients. The main outcome of the study was preeclampsia defined by widely used practice parameters, which include hypertension and proteinuria occurring in the course of pregnancy beyond the 20th week. Further, neonatal consequences including birth weight and Apgar rating, which can be effects of low-dose aspirin on pregnancy were also assessed.

Statistical Analysis

Data were analyzed using SPSS v23. Continuous variables, such as gestational age and birth weight, were expressed as mean ± standard deviation and compared using t-tests. Categorical variables, including the incidence of preeclampsia, were analyzed using chi-square tests. A p-value of less than 0.05 was considered statistically significant, ensuring the reliability and validity of the findings.

RESULTS

Data were collected from 165 patients. Maternal age was 30.5 ± 4.2 years in the aspirin group and 31.0 ± 4.0 years in the placebo group (p = 0.48). Gestational age at enrollment averaged 13.8 ± 1.2 weeks and 13.7 ± 1.3 weeks for the aspirin and placebo groups, respectively (p = 0.65). BMI was 29.5 ± 3.8 kg/m² in the aspirin group and 29.8 ± 3.5 kg/m² in the placebo group (p = 0.72). Key risk factors, such as chronic hypertension (20% vs. 22%, p = 0.76) and history of preeclampsia (18% vs. 20%, p = 0.68), were evenly distributed.

Table 1

Demographic and Baseline Characteristics

Characteristic	Aspirin Group (n=83)	Placebo Group (n=82)	p-value
Maternal Age (years)	30.5 ± 4.2	31.0 ± 4.0	0.48
Gestational Age at Enrollment (weeks)	13.8 ± 1.2	13.7 ± 1.3	0.65
Body Mass Index (BMI, kg/m²)	29.5 ± 3.8	29.8 ± 3.5	0.72
Chronic Hypertension (%)	20% (17)	22% (18)	0.76
History of Preeclampsia (%)	18% (15)	20% (16)	0.68
Diabetes Mellitus (%)	12% (10)	11% (9)	0.89
Multiple Gestations (%)	15% (12)	14% (11)	0.83
Baseline Systolic BP (mmHg)	125.6 ± 10.5	126.2 ± 11.0	0.77
Baseline Diastolic BP (mmHg)	78.4 ± 7.5	78.6 ± 7.8	0.90

The results revealed a significantly lower incidence of preeclampsia in the aspirin group (10%, 8 out of 83) compared to the placebo group (25%, 21 out of 82), with a notable reduction in risk. Similarly, the incidence of

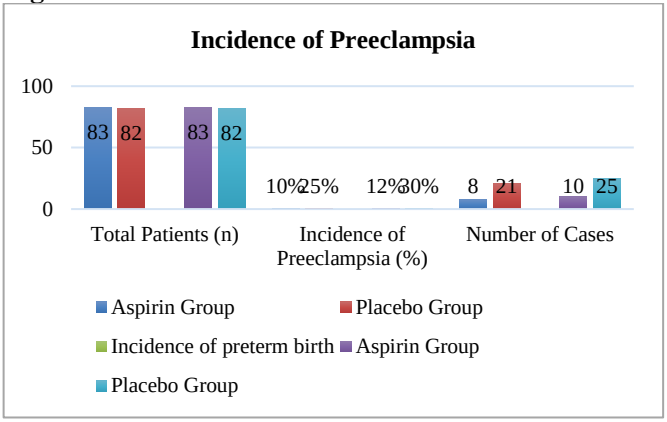
preterm birth was significantly lower in the aspirin group (12%, 10 out of 83) than in the placebo group (30%, 25 out of 82).

Table 2

Incidence of Preeclampsia

Group	Total Patients (n)	Incidence of Preeclampsia (%)	Number of Cases
Aspirin Group	83	10%	8
Placebo Group	82	25%	21
Incidence of Preterm Birth			
Aspirin Group	83	12%	10
Placebo Group	82	30%	25

Figure 1



The mean gestational age at delivery was significantly higher in the aspirin group (38.2 ± 1.5 weeks) compared to the placebo group (36.8 ± 2.0 weeks).

Table 3

Gestational Age at Delivery

Group	Total Patients (n)	Mean Gestational Age (weeks)	Standard Deviation
Aspirin Group	83	38.2	±1.5
Placebo Group	82	36.8	±2.0

The neonatal outcomes significantly favored the aspirin group. The mean birth weight was higher in the aspirin group (3,200 ± 400 grams) compared to the placebo group (2,900 ± 450 grams, $p < 0.05$). Preterm birth occurred less frequently in the aspirin group (12%, 10 out of 83) than in the placebo group (30%, 25 out of 82, $p = 0.02$). Neonatal ICU admissions were also lower in the aspirin group (5%, 4 out of 83) compared to the placebo group (15%, 12 out of 82, $p = 0.03$). Additionally, the incidence of low Apgar scores (<7 at 1 minute) was reduced (3% vs. 10%, $p = 0.05$), as was fetal growth restriction (5% vs. 15%, $p = 0.03$).

Table 4

Fetal Growth and Neonatal Outcomes

Outcome	Aspirin Group (n=83)	Placebo Group (n=82)	p-value
Birth Weight (grams)	3,200 ± 400	2,900 ± 450	<0.05
Preterm Birth (%)	12% (10)	30% (25)	0.02
Neonatal ICU Admission (%)	5% (4)	15% (12)	0.03
Apgar Score <7 at 1 Min (%)	3% (3)	10% (8)	0.05
Fetal Growth Restriction (%)	5% (4)	15% (12)	0.03

DISCUSSION

The findings of this study underscore the significant efficacy of low-dose aspirin in preventing preeclampsia in high-risk pregnancies. With a reduction in the incidence of preeclampsia from 25% in the placebo group to 10% in the aspirin group, the results align with existing literature advocating the prophylactic use of aspirin in such populations. However, it is noteworthy to add, that apart from the above improvements of numerator in MMR, the observed changes in gestational weeks at delivery, birth weight and observed decreases in preterm births and fetal growth restriction speak not only about expansion of the primary effect of the intervention, but mainly about the overall positive impact on mothers and newborns [11]. By significantly cutting down the incidence of preeclampsia thereby recommending low-dose aspirin, the study brings in fitness with reference to low-cost, easily accessible and effective intervention measure for high-risk pregnancies [12]. This benefit can be attributed to the action of aspirin that has properties that counter-coagulants effect and equally reduces inflammation allowing for better perfusion of the placenta through prevention of platelet aggregation. Increased blood flow in the placenta might also have played a role in the increased mean birth weights, as well as fewer rates of fetal growth restrain in the aspirin group. Gestational age at delivery was significantly increased in the aspirin group and there were less cases of preterm birth than those receiving placebo [13]. This finding is more so remarkable especially because preterm birth is one of the leading causes of neonatal morbidity and mortality. Low-dose aspirin may help protect against preeclampsia and related complications step in reducing the of very preterm births and their lasting effects on neonatal outcomes. The findings are in line with guidelines from World Health Organization WHO and The American College of Obstetricians and Gynecologists ACOG, both recommending the use of the low dose aspirin for preeclampsia prevention in high risk pregnancy [14]. A previous research work has established such kind of declines in preeclampsia, preterm birth and fetal growth restriction and, hence endorse the current study. From the method used in this study, one can pointed out the following study strength: Randomized and controlled placebo design reduces the possibility of bias and provides high reliability of the results. The baseline characteristics of the two groups have also presented a balanced nature thus ensuring that significant differences

can be attributed to the intervention. Moreover, the sample of 165 participants is large enough to note statistically significant differences when using different types of analysis [15]. However, there is some weakness in the study. Using self-reports to measure adherence to aspirin therapy may be problematic since those who fail to take the aspirin, the effect may be reduced and this could be a major source of bias [16]. Furthermore, the participants in the study were drawn from one region only, thus might not reflect other study populations with other demographic, and socioeconomic characteristics. Based on the findings of the present research, low dose aspirin usage in pregnancy should be prescribed during routine prenatal care of high-risk pregnancies. It has moderate cost, and is safe enough to be used even in low-resource environments. It was found that timing of intervention also play efficient role, adjuvant therapy before 16 weeks of gestation seems to be vital for better results. Specialist should intervene early in such pregnancies and therefore healthcare providers should take adequate history and assess risk factors with a view of identifying high risk pregnancies for early management.

CONCLUSION

It is concluded that low-dose aspirin is an effective and safe intervention for preventing preeclampsia in high-risk pregnancies. The study demonstrated a significant reduction in the incidence of preeclampsia, preterm births, and fetal growth restriction among participants who received low-dose aspirin compared to those in the placebo group.

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