Comparison of neonatal complications in pre-eclamptic and spontaneous preterm labour in the Persian Gulf Hospital of Bandar Abbas City, Iran, from 2011-2016

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Abstract

Introduction: Pre-eclampsia is an important disease that affected 3.7% of infants and led to 18% of maternal deaths. In addition to maternal complications, fetal complications are also a major contributor to pre-eclampsia.

Objectives: To evaluate the neonatal outcome of preterm labour (PTL) due to pre-eclampsia and compare its complications with those of spontaneous PTL.

Method: A cross-sectional study was carried out on 190 cases of PTL using a randomized sampling method, in which 94 pregnant women with pre-eclampsia and 96 women with spontaneous PTL participated. Infant characteristics, including weight, height, head circumference, as well as respiratory disorders, Apgar score, jaundice, and mortality were recorded from medical files. Statistical analysis was done using SPSS ver. 20 via t-test, and Chi-squared test.

Results: The mean ages of mothers with pre-eclampsia and spontaneous PTL were 27.76±7.06 and 26.94±4 years, respectively. The numbers of hospitalisation days in neonatal intensive care unit (NICU), birth weights, Apgar scores at 1 and 5 minutes, head circumference, and jaundice were significantly different in the two groups. However, respiratory distress, number of infant deaths, and the length of the infants were not significantly different in the two groups.

Conclusions: In this study on preterm infants, pre-eclampsia had a significant impact on NICU hospitalisation rate, length of stay in NICU, Apgar scores in first and fifth minutes, the incidence of jaundice, weight, and head circumference at birth, but not on the length of the baby or respiratory distress.

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(Key words: Pre-eclampsia, preterm labour, neonates)

Introduction

Pre-eclampsia is defined as the incidence of hypertension greater than 140/90 mm Hg after 20 weeks of gestation with proteinuria, with or without oedema, and no previous history of hypertension. It may occur at any time during the second half of pregnancy and at or within 48 hours after delivery. It affects 8% of pregnant women and can lead to maternal and newborn death. Further, the risk of preterm delivery and intrauterine growth retardation are increased. Most women with pre-eclampsia have a mild form near labour, and if they receive proper care, they and/or their fetuses are not at risk. Despite recent attempts to understand the pathophysiology of pre-eclampsia, there is still no definitive prevention and effective treatment other than termination of pregnancy. During normal pregnancy, blood vessels of the placenta exchange the nutrients and waste material between mother and fetus. Abnormal growth of the placenta leads to impaired function, especially in pre-eclamptic pregnancies that result from oxidative stress, hypoxia, and release of factors that cause endothelial dysfunction and inflammation.

The risk factors for preterm labour (PTL) include maternal or infant medical conditions, genetic disorders, environmental factors, infertility treatment, social, economic and behavioural factors,
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and unknown causes. The infant complications of PTL include respiratory distress syndrome, jaundice, prematurity, long-term brain dysfunction, pulmonary dysfunction, and ophthalmic disorders. PTL and its short- and long-term complications are a serious problem that results in disability and increased health care costs. The lack of precise knowledge of the mechanism of early onset of labour is a limitation in its effective treatment. Use of modern techniques for preventing pregnancy complications is an important task in prenatal care.

Pre-eclampsia has been associated with a 5% reduction in birth weight and an increase of 4-times for small for gestational age (SGA). Conversely, the prevalence of large for gestational age (LGA) in the early stages of pre-eclampsia has been reported before the last two weeks of gestation. Oxidative stress can also play a role in the pathogenesis of pre-eclampsia. The main source of active oxygen species (ROS) is the xanthine oxidase enzyme, which is mainly active in the liver. One hypothesis is that the increase in purine catabolism is due to placental hypoxia, which leads to an increase in the production of ROS in the mother's liver and releases into the mother's circulation, causing damage to the endothelial cells.

Some studies have suggested that more calcium intake or low-dose aspirin may aid prevention or treatment of pre-eclampsia, but the results of these studies are not very positive, and most clinicians do not recommend them for women who are at lower risk. Considering its relatively high prevalence and associated complications, early diagnosis and treatment of pre-eclampsia can benefit both mother and child. There are only a few studies on the fetal complications of PTL due to pre-eclampsia in the Iranian population, and the results of these limited studies are also controversial.

Objectives

To evaluate the neonatal outcomes of PTL due to pre-eclampsia, and to compare its complications with those of spontaneous PTL.

Method

A cross-sectional study was performed on 190 women with PTL attending the Persian Gulf Hospital of Bandar Abbas, Iran, from 2011 to 2016. After obtaining clearance from the Ethics Committee of the Faculty of Medicine (approval code: IR.HUMS.REC.1397.162), 190 cases of PTL of fewer than 37 weeks were selected randomly, according to the table of random numbers, from the medical records from 2011 to 2016 according to inclusion criteria. The first group consisted of 94 cases of PTL due to pre-eclampsia, and the second group included 96 women with spontaneous PTL.

Data was collected via a checklist to record the days of admission to the NICU, the mean weight, height, and head circumference, the Apgar score in the first and fifth minutes, respiratory distress, jaundice (at least 5 mg/dL). In the case of incomplete files, the investigation process was removed.

Statistical analysis: Quantitative information was presented as means, standard deviations, and numbers or percentages. Analysis of data was done using SPSS version 20. To compare the two groups in quantitative variables, we first examined their distribution in each group. In the case of normalization of these variables in each group, the independent t-test, Pearson correlation coefficient, Mann-Whitney's non-parametric tests and Spearman correlation coefficient were used. Due to the normalization of the data, only the parametric tests were used. Normality was determined by the Kolmogorov-Smirnov test. The significant difference was set at less than 0.05.

Results

The mean ages of the mothers with and without pre-eclampsia were 27.06±7.7 and 26.94±4 years, respectively. This was not significant (p>0.05).

The characteristics of the infants in the studied group are shown in Table 1.

| Variable                      | Preeclamptic group (n=94) | Spontaneous PTL group (n=96) | P-value |
|-------------------------------|---------------------------|-----------------------------|--------|
| Birth weight in kg (mean± SD) | 2.41± 0.42                | 2.62± 0.42                  | 0.001  |
| Length in cm (mean± SD)       | 49.65± 3.52               | 50.52± 3.16                 | 0.074  |
| Head circumstance in cm (mean± SD) | 34.28± 3.36                | 35.33± 1.22                 | 0.005  |
| Infants hospitalized in NICU n (%) | 63 (67)                    | 42 (45)                     | 0.001  |
| Length of stay in NICU in days | 1.38± 1.73                 | 0.56± 1.27                  | 0.001  |
| Apgar score: At one minute    | 7                         | 8                           | 0.001  |
| At five minutes               | 8                         | 9                           | 0.001  |
| Respiratory distress n (%)    | 23 (24.4)                  | 16 (16.6)                   | 0.18   |
| Death n (%)                   | 9 (9.5)                    | 3 (3.1)                     | 0.068  |
| Jaundice n (%)                | 78 (82.9)                  | 45 (46.8)                   | 0.001  |

PTL: Pre-term labour

Table 1: Characteristics of the infants in the studied group
Birth weights of infants of mothers with pre-eclampsia were significantly lower than birth weights in the spontaneous PTL group \( (p=0.001, p<0.01) \). However, the length at birth was not significantly different in infants of pre-eclamptic group compared to the spontaneous PTL group \( (p=0.074, p>0.05) \). According to the independent \( t \)-test, the head circumference was significantly lower in infants of pre-eclamptic group compared to the spontaneous PTL group \( (p=0.005, p<0.01) \).

The number of infants hospitalised in the neonatal intensive care unit (NICU) was significantly higher in mothers with pre-eclampsia in comparison with the infants in the spontaneous PTL group \( (p=0.001, p<0.01) \). The length of stay in the NICU was significantly longer in infants of the pre-eclamptic group compared to the spontaneous PTL group \( (p=0.005, p<0.01) \). The mean Apgar score in the infants of mothers with pre-eclampsia was significantly lower than in infants in the spontaneous PTL group in both the first and fifth minutes after birth \( (p=0.001, p<0.01) \).

The Pearson Chi-Square test revealed that there was no significant difference in the numbers of babies developing respiratory distress in the 2 groups \( (p=0.18, p>0.05) \). Also, based on the Pearson Chi-Square test, deaths in premature infants was not significantly different in the two groups \( (p=0.068, p>0.05) \). According to the Pearson Chi-Square test, the prevalence of jaundice in infants of mothers with pre-eclampsia was significantly higher than in infants of mothers undergoing spontaneous PTL \( (p=0.001, p<0.01) \).

Discussion

PTL causes 70% of neonatal deaths, and its prevalence varies in different areas, being 5.6% in developed countries but in developing countries ranging from 1.8% to 16.7%\(^ {14,15} \). In Iran, the prevalence has been reported to be 4–10%\(^ {16} \). Complications due to PTL are common causes of death in neonates. According to studies, from 5% to 15% of all deliveries result in preterm infants, and approximately 91% mortality and morbidity occur in preterm infants\(^ {17} \). The birth rate of premature infants is 9-12% in America, 5-7% in Europe, and 5-9% in developing countries\(^ {18,19} \). This rate in Iran has varied in different studies and different parts of the country. In a study in Tehran, prevalence of PTL was 7.8%, in Zanjan it was 7%, and in Mashhad it was 16.4%\(^ {20,21} \). In a study by Khadem \textit{et al}, prevalence of PTL was 54.4% in patients with pre-eclampsia and 25% in healthy mothers\(^ {22} \). In a study by Nehbandani \textit{et al}, PTL in mothers with pre-eclampsia was 29.2%, while in the meta-analysis performed by Khadem \textit{et al}, PTL was observed in 0.05% of women\(^ {24} \). The reason for the difference in outcome may be the type of decision-making in the administration of pre-eclampsia. While other causes of neonatal morbidity and mortality have decreased, the complications of PTL have not yet been resolved and are currently considered the most important issue in neonatal medicine\(^ {25} \). The results of our study showed that the number of days hospitalised in NICU among mothers with pre-eclampsia was higher than in the spontaneous PTL group. The study by Khadem \textit{et al}. showed that mothers with pre-eclampsia, and healthy mothers were significantly different in terms of the length of stay in NICU. In their study, there were 8% admissions to the NICU by the control group compared to 31% admissions by the case group\(^ {26} \). The duration of hospitalisation was more than three days in the cases\(^ {27} \). In another study by Safari and Yazdampanah, the prevalence of pre-eclampsia in the NICU group was 25.6% and 10.2% in the control group\(^ {28} \). Similar results were found in a study by Cruz \textit{et al} where the length of stay in NICU was lowest in healthy mothers and increased in mild and severe pre-eclampsia groups\(^ {29} \). Also, Basiri \textit{et al}. demonstrated that pre-eclampsia was more prevalent in the non-survived neonate than in those hospitalised in NICU\(^ {29} \).

In our study, the 1 and 5 minute Apgar scores in infants of mothers with pre-eclampsia were lower in comparison with the spontaneous PTL group. Similarly, in the study by Khadem \textit{et al}. in mothers with pre-eclampsia and healthy mothers, there was a significant difference in the Apgar scores at 5 minutes after birth\(^ {23} \). Tran \textit{et al}. findings show that pre-eclamptic newborns had lower 1 minute Apgar scores than non-pre-eclamptic babies\(^ {30} \). In a study by Fallahian \textit{et al}. on the effects of high blood pressure in pregnant women on neonates in Taleghani Hospital in 1999, findings indicated that in the hypertensive group, the lower aphrodisiac was 9-times more than the control group\(^ {25} \). The study by Nehbandani \textit{et al}. showed that the Apgar score below 7 at birth was related to the complications of neonates of mothers with pre-eclampsia\(^ {25} \).

In our study, weight and head circumference result in preterm infants of mothers with pre-eclampsia were significantly lower than those of spontaneous PTL group. However, the length at birth was not significantly different in preterm infants of mothers with pre-eclampsia compared to the spontaneous PTL group. In the study by Avorgbedor \textit{et al}, although mean infant length at 2 months was less in the pre-eclamptic group than the control group, other growth and neurodevelopmental outcomes did not differ between the groups\(^ {31} \). The study by Fallahian \textit{et al}. showed that in pregnant mothers with hypertension, the weight of infants was 2 times higher than the control group\(^ {23} \). A study by Balogun \textit{et al}. revealed that women with preterm pre-
eclampsia with severe features had significantly higher risk of fetal growth restriction when compared with those with the normal group\textsuperscript{32}. These results are consistent with the study of Khadem \textit{et al}\textsuperscript{23}. Accordingly, our study findings suggested that attention to exact control of pre-eclampsia and avoidance of making rash decision for terminating pregnancy in mild pre-eclampsia could improve outcomes of neonates.

\textbf{Conclusions}

In this study on preterm infants, pre-eclampsia had a significant impact on NICU hospitalisation rate, length of stay in NICU, Apgar scores in first and fifth minutes, the incidence of jaundice, weight, and head circumference at birth, but not on the length of the baby or respiratory distress.

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