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Original Research Article

A comparative study on preterm birth in elderly mothers and young mothers

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ABSTRACT

Background: In the present-day scenario women are career oriented and ambitious. They might not want to spoil their focus by getting pregnant. Late motherhood helps them sort their career, and when they do have children, it allows them to spend more time and money on their kids. In order to achieve this woman are choosing to embrace the motherhood in later age. Most of them not understanding the consequences of delayed marriage and late pregnancy. Advanced maternal age at birth has been found to be associated with preterm delivery, low birth weight, intrauterine foetal death and increased perinatal morbidity and mortality The aim of our study was to know the preterm birth in elderly mothers and young mothers, and to compare preterm births in these two groups.
Methods: Our study was a cross sectional, analytical case control study, done in babies delivered to mothers >35 years and ≤35 years. Information like age of the mother, gestational age, period of gestation at birth etc were recorded in a proforma. Collected data was analysed using frequency, percentage, chi square test and odds ratio
Results: In our study, total sample size was 460 (230 cases and 230 controls). Incidence of preterm deliveries were significantly more in case group (babies born to mothers >35 years) than the control group (babies born to mothers between 19 to 35 years).
Conclusions: It was observed that premature births were more common in babies born to elderly mothers than young mothers.

Keywords: Advanced maternal age, Gestational age, Preterm birth

INTRODUCTION

Now a days more and more women are focusing on obtaining higher education and reaching career objectives. This has in turn lead to delayed marriage and child birth at a later age. Advanced maternal age at birth has been found to be associated with preterm delivery, low birth weight, intra uterine foetal death and increased perinatal morbidity and mortality.[1]

In the United States, between 1970 and 2006, the proportion of pregnant women aged over 35 years has increased almost eight times.[2] Therefore, researchers have been interested in outcomes of pregnancy in women of advanced age.[3-6]

Increased maternal age has been regarded as a risk factor for complications in pregnancy. The association between increased maternal age and increased risk of chromosomal abnormalities and spontaneous abortion is well known.[7,8]

Preterm birth is the most important factor determining neonatal morbidity and mortality, and has a major impact on it. However, in literature, the association between prematurity and advanced maternal age remains

controversial. A study on more than 80,000 women revealed that 36% of the increase in prematurity, between 1990 and 1996 in Canada, was attributable to the change towards increasing maternal age.[9]

Advanced maternal age at birth has been found to be associated with gestational diabetes, pre-eclampsia, placenta previa, caesarean section (CS), placental abruption, preterm delivery, low birth weight, intrauterine foetal death and increased perinatal morbidity and mortality.[10]

METHODS

Study design

It was a cross-sectional and the analytical case-control study.

Cross-sectional: The study was conducted at a single point in time, meaning that data was collected from a specific period (from 1st September 2015 to 31st August 2017). This type of study provides a snapshot of the health outcomes at that moment but doesn't track changes over time.

Analytical: The study is focused on analysing and comparing data between different groups to determine any significant relationships or differences in outcomes.

Case-control: The study compares two groups.

Cases: The group of babies born to mothers aged over 35 years, considered the "exposed" group.

Controls: The group of babies born to mothers aged under 35 years, considered the "unexposed" group. These babies are matched with cases based on delivery timing and mode of delivery to minimize bias and control confounding factors (like delivery complications).

Participants

Cases: Neonates born to mothers who were over the age of 35 at the time of delivery.

Controls: Neonates born to mothers who were under the age of 35. They were selected in a 1:1 ratio (the same number of cases and controls). To reduce potential confounding factors, the controls were carefully chosen to match the cases based on:

Timing: The control mother delivered immediately after the case mother.

Mode of delivery: The delivery method (e.g., vaginal birth, caesarean section) was the same for both case and control, since different delivery methods can influence neonatal outcomes.

Inclusion criteria

All neonates born during the study period were considered for inclusion, but only those whose mothers age fit the inclusion criteria (greater or less than 35 years) were selected.

Exclusion criteria

Neonates born to mothers with chronic illnesses such as lung, kidney, or heart diseases were excluded from the study. This exclusion is important because chronic illnesses could independently affect pregnancy and neonatal outcomes, creating confounding variables. By excluding these mothers, the study focused only on age-related outcomes without the interference of other underlying health conditions.

Sample size calculation

Sample size was calculated using following formula.

$N=1.96\times1.96(pq)/d^2$

Where:

N=Sample size needed.

1.96=The Z-value corresponding to a 95% confidence level (this reflects the confidence we have that the results are not due to chance).

p=Proportion of elderly pregnant women (aged > 35) who are expected to have an abnormal pregnancy outcome. This is estimated based on previous studies or expectations.

q=1-p (since the total must equal 1, q is simply the complement of p).

d=Absolute precision, set to 10%. This represents the margin of error you are willing to accept in the results.

By using this formula, the study ensures that the sample size is large enough to detect meaningful differences between the groups (mothers > 35 years vs. mothers < 35 years), thus increasing the validity and reliability of the findings.

Data collection and analysis

Data compilation: The collected data from the hospital records of both mothers and neonates were entered into a Microsoft excel sheet. This is an essential step to organize and structure the data before any analysis can be conducted.

Statistical software: The data were then analysed using SPSS (Statistical package for the social sciences) version

16. SPSS is a widely used software for statistical analysis in research. It allows for both descriptive and inferential statistical tests to examine patterns and relationships in the data.

Key variables

The primary variables being compared are:

Preterm vs. term births: The study compares the rates of preterm (babies born before 37 weeks of gestation) and term (babies born between 37 and 42 weeks) births among mothers over and under 35 years old.

The outcome of interest is whether maternal age influences the likelihood of preterm birth or term birth.

Statistical analysis

Chi-square test: This test is used to compare the observed frequency of events (e.g., preterm births) between the two groups (mothers aged >35 vs. mothers aged <35). It helps determine if the differences observed between the groups are statistically significant or could have occurred by chance.

Confidence interval (CI): The CI provides a range within which the true value of the outcome (e.g., the proportion of preterm births) is likely to fall, with a certain level of confidence (usually 95%).

For example, a 95% CI means that if the study were repeated multiple times, 95% of the time the true value would fall within this interval.

Odds ratio (OR): This is a measure of the odds of an event (e.g., preterm birth) occurring in one group (e.g., mothers over 35 years) compared to another group (e.g., mothers under 35 years).

It helps quantify the strength of the association between maternal age and neonatal outcomes. An OR greater than 1 suggests that the event is more likely in the case group, while an OR less than 1 suggests it is less likely.

Fisher's exact test: This test is used when the sample size is small or when expected values in contingency tables are low.

By using these statistical methods, the study aims to draw valid conclusions about the relationship between maternal age and neonatal outcomes, such as preterm birth rates. It ensures that the findings are robust, meaning that any differences observed between the groups (mothers >35 vs. mothers <35) are not due to chance but are likely a real effect.

This detailed method section reflects a rigorous approach to study design, ensuring the study findings are accurate and can be generalized to the broader population.

Operational definition

Preterm: Babies born before 37 completed weeks of gestation (258 days).[13]

Extremely preterm: Babies born before 28 weeks of gestation.

Early preterm: Babies born between 28-31 weeks of gestation.

Moderate preterm: Babies born between 32-33 weeks gestation.

Late preterm: Babies born between 34-36 weeks of gestation.

Term: >37 weeks of gestation.

RESULTS

Sample distribution and key statistics

Total sample size was 460 participants, in cases (Mothers >35 years): 230 and in the controls (Mothers <35 years): 230 were included.

This balanced sample design ensures comparability between groups, reducing bias and improving the reliability of your results.

Overall preterm birth risk

Preterm births in cases (>35 years): 49/230 (21%) and in preterm births in controls (<35 years): 12/230 (5%) were included.

Chi-square value: 25.87 (highly significant), p<0.0001 (highly significant) OR:4.918, 95% CI: 2.53-9.52.

Interpretation

The OR=4.918 indicates that mothers over 35 years have nearly 5 times greater odds of delivering a premature baby compared to younger mothers.

The 95% CI (2.53-9.52) confirms the result's precision and significance-the true odds are likely within this range.

The highly significant p<0.0001 implies that mothers aged more than 35 years have 4.918 times more risk of delivering premature babies (Table 2).

In total 230 cases (>35 years), extremely preterm babies were 3, early preterm were 8, late preterm were 38 and term were 181. Where as in control group, none were extremely preterm, early preterm were 3, late preterm were 9 and term were 218 (Table 3).

Table 1: Demographic data and clinical characteristics in mothers aged >35 years and <35 years.

Variables	Mothers' age (in years)	
	>35	**<35**
Mean age of mothers	36.54	23.09
Residence		
Rural	84	122
Urban	146	108
Education		
Graduate	196	153
Non-graduate	34	77
Mode of delivery		
Vaginal delivery	97	156
LSCS	34	74
Gestation age		
Extremely preterm	3	0
Early preterm	8	3
Late preterm	38	9
Term	181	218
APGAR at 1 min		
Less than 7	21	11
More than 7	209	219
Apgar at 5 min		
Less than 7	5	2
More than 7	225	227
NICU admission		
Yes	59	18
No	171	212

Table 2: Preterm and term babies born to mothers aged >35 years and <35 years.

Mothers	Term	Percentage	Preterm	Percentage	Total
>35 years	181	79	49	21	230
≤35 years	218	95	12	5	230
Total	399	86	61	14	460

Table 3: Extreme, early, late preterm and term babies in mothers aged >35 years and <35 years.

Gestation age	>35 years	<35 years
Extremely preterm	3	0
Early preterm	8	3
Late preterm	38	9
Term	181	218

DISCUSSION

Out of 230 mothers above 35 years, 49 delivered prematurely in comparison with 12 mothers who delivered prematurely in the control group (<35 years). The p<0.0001, which was statistically highly significant.

Comparison with existing literature

Our results are consistent with previous research that has highlighted the increased risk of preterm birth in older mothers. Minoo et al and Berkowitz et al also reported higher incidences of preterm births among women aged 35 years or older. These studies, like ours, emphasize the need to monitor pregnancies in this age group closely, given the increased risk of complications such as preterm birth, low birth weight, and neonatal morbidity.[11,12]

One of the significant findings from our study is the stark contrast in preterm birth rates between mothers over 35 years and those under 35. The p<0.0001 confirms that the difference is not due to chance, reinforcing the notion that advanced maternal age is a distinct risk factor for preterm birth. In our study, 21.3% of mothers aged 35 years and above delivered preterm, a rate much higher than the general population's average preterm birth rate, which is typically around 10-12%. This elevates the need for

healthcare providers to recognize and address the potential risks that come with maternal age.

In a large cohort study by Florent et al it was found that maternal age, particularly 40 years and older, is strongly associated with an increased risk of preterm birth. Our findings are in agreement with this, as they suggest a higher incidence of preterm birth in women over 35. Given that maternal age is a significant factor, there is a growing body of research linking older maternal age to adverse pregnancy outcomes, including preterm labor, gestational hypertension, and caesarean delivery.[14]

Moreover, our findings align with those reported in the study by Lawlor et al conducted on a population of Danish women, which identified a U-shaped relationship between maternal age and preterm birth. Their research showed that the risk of preterm birth was lowest between the ages of 24 and 30, while it increased for both younger and older age groups. While our study did not focus on younger mothers (<24 years), it would be valuable to explore whether younger maternal age is also associated with an elevated risk of preterm birth, as suggested by Lawlor's findings. This could provide a more complete understanding of the relationship between maternal age and preterm birth, as it may indicate that both ends of the maternal age spectrum pose risks.[15]

Giovanna et al conducted a retrospective cohort study in Lombardy, Northern Italy, which provides valuable insights into how maternal age influences the risk of preterm birth (PTB) in both singleton and multiple pregnancies. Their findings indicate that maternal age exhibits a U-shaped relationship with PTB risk, where both younger and older mothers are at elevated risk compared to those in their mid-reproductive years.[16]

The study by Fall et al examined the relationship between maternal age at childbirth and offspring outcomes in five low- and middle-income countries (LMICs). Using data from the COHORTS collaboration, the study found that both younger mothers (≤19 years) and older mothers (≥35 years) were associated with higher risks of preterm birth.[17]

Possible mechanisms linking advanced maternal age to preterm birth

The association between advanced maternal age and preterm birth is likely multifactorial. As maternal age increases, there are several physiological and biological factors that could contribute to the increased risk:

Decreased uterine and placental function

As women age, there is a decline in uterine and placental function, which can lead to poor placental implantation, reduced blood flow, and compromised nutrient supply to the foetus. These factors can increase the likelihood of preterm labor and delivery.

Increased risk of underlying medical conditions

Older mothers are more likely to have chronic medical conditions such as hypertension, diabetes, and preeclampsia, which can contribute to preterm birth. These conditions can cause complications such as uteroplacental insufficiency, which in turn may trigger early delivery.

Higher likelihood of assisted reproductive technologies (ART)

Women over 35 are more likely to conceive through ART, such as in vitro fertilization (IVF). ART pregnancies are known to carry an increased risk of preterm birth, due to factors like multiple gestations (twins, triplets, etc.) and the inherent risks associated with assisted conception.

Changes in hormonal regulation

As women age, there may be changes in the hormonal regulation of pregnancy, particularly the levels of progesterone, which is essential for maintaining pregnancy. Imbalances in these hormones may increase the risk of early labor.

Chromosomal abnormalities

Advanced maternal age is associated with an increased risk of chromosomal abnormalities, such as Down syndrome. In some cases, preterm labor may be induced to manage fetal abnormalities, which could contribute to the higher rates of preterm birth in older mothers.

Implications for clinical practice

Our study's findings emphasize the importance of closely monitoring pregnancies in women aged 35 and above. Healthcare providers should be aware of the increased risk of preterm birth in this group and consider earlier or more frequent prenatal visits to detect any signs of complications early. Additionally, these women should be educated about the potential risks of preterm birth and other pregnancy-related complications, and be provided with strategies to optimize pregnancy outcomes, such as:

Preconception counselling

Women of advanced maternal age should be counseled before pregnancy about the risks associated with delayed childbearing, including the increased likelihood of preterm birth. In some cases, lifestyle changes or medical interventions may be recommended to reduce risks.

Increased surveillance

Pregnant women over 35 should receive regular monitoring for signs of preterm labor, hypertension, gestational diabetes, and other conditions that could lead

to premature delivery. Early intervention, such as bed rest, medication, or even hospitalization, could help prolong pregnancy when necessary.

Consideration of ART

For women who conceive via ART, healthcare providers should be aware of the higher risk of multiple gestations and preterm birth associated with these pregnancies. Special care should be given to ART pregnancies, including more frequent ultrasounds and monitoring.

Antenatal corticosteroid use

In cases where preterm birth is anticipated, the use of antenatal corticosteroids to accelerate foetal lung maturation should be considered. This intervention can significantly reduce neonatal morbidity and mortality in preterm infants.

Limitations

While our study provides valuable insights, there are some limitations to consider:

Retrospective design: Our study relied on medical records, which may have missing data or inaccuracies in recording preterm birth outcomes.

Single-centre study: The study was conducted at a single hospital, which may limit the generalizability of the results to other populations or regions.

Exclusion criteria: We excluded mothers with chronic illnesses, which may have removed an important subset of the population who could potentially have different risks for preterm birth. Including these women in future studies could offer a more comprehensive picture of the factors influencing preterm birth.

In this study confounding factors like gestational diabetes and hypertension are not considered, which are also significant risk factors for occurrence of the preterm delivery.

CONCLUSION

Our study confirms that advanced maternal age is a significant risk factor for preterm birth. The results are consistent with findings from previous studies and support the need for heightened clinical awareness and intervention in pregnancies involving women aged 35 years and older. Further research is needed to explore the underlying mechanisms that contribute to this increased risk and to investigate the potential role of younger maternal age in preterm birth. Ultimately, improving prenatal care and ensuring that women are well-informed about the risks associated with advanced maternal age could help mitigate the potential complications and improve maternal and neonatal outcomes.

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