Original Article

Early Predictors of Preterm Labor

Early Predictors of Preterm Labor: Single Center Retrospective Study

Rana Hatem Matrood Alkhazraji

ABSTRACT

Objective: To identify possible risk factors of preterm birth.

Study Design: A retrospective cohort study

Place and Duration of Study: This study was conducted at the Diwaniyah Maternity Hospital, Diwaniyah province, Iraq from 1st January 2025 to 30th June 2025.

Methods: During this study, records of women with single gestation for the last five years (January 2020 to January 2025) were retrieved and analyzed. After reviewing all reports of pregnant women admitted to Maternity Teaching Hospital, twin pregnancies and cases with abortion were excluded from study. The first case for each year of the five years of the study was selected based on a random number generated by the Microsoft Excel software and then Systematic random sample was applied by selecting every other 10 cases. Only women with singleton pregnancy who gave birth after 28 weeks gestation and ther age was in the range of 18 to 45 years were enrolled. At the end of the study, 428 cases of women with singleton pregnancy were enrolled.

Results: Logistic regression analysis confirmed the findings of univariate analysis in that age, body mass index, history of abortion and history of preterm are the significant predictors of preterm labor ($p<0.05$). An increase of one year of age is associated with 1.14 increased risk of preterm labor ($p<0.001$). An increase of one kg/m^2 of body mass index is associated with 1.57 increased risk of preterm labor ($p<0.001$). History of abortion is associated with 10.53 increased risk of preterm ($p=0.003$) and history of preterm labor is associated with 28.82 increased risk of preterm ($p=0.003$).

Conclusion: Advanced maternal age >40 years, high body mass index >25 kg/m^2, previous abortion and previous preterm labor are associated with increased likelihood of preterm labor.

Key Words: Preterm labor, Maternal age, Body mass index

INTRODUCTION

According to the World Health Organization, preterm birth is considered when delivery of live baby happens before complete 37 weeks of gestation and it can be further categorized as extremely preterm (before 28 weeks), very moderately (between 28 and 32 weeks), moderate preterm (between 32 and 34 weeks), and late preterm (between 34 and 37 weeks).[1] The condition can be spontaneous[2] or can be associated with early rupture of membrane.[3] The estimated global incidence rate of preterm labor was 9.9 % at 2020.[4] In Iraq, the annual incidence rate of preterm labor is approximately 6.5%.[5] This condition is associated with increased rates of neonatal morbidity and mortality.[6]

Department of Obstetrics & Gynecology, College of Medicine, University of Al-Qadisiyah, Iraq

Correspondence: Dr. Rana Hatem Matrood Alkhazraji, Assistant Professor, Department of Obstetrics & Gynecology, College of Medicine, University of Al-Qadisiyah.
Contact No: 009647800722078
Email: rana.hatem@qu.edu.iq

In general the complications, in association with prematurity, show inverse correlation to gestational age.[7] Therefore, preventing these long term complications via early recognition of women at risk of preterm labor with successful medical intervention to delay birth as near as possible to term onset is the best way to reduce the burden of such long term complications. Actually, there is strong evidence that even late preterm neonates are at higher risk of long - and short -term complications in comparison to their term counterparts including metabolic syndrome, neurodevelopmental delay, infection, jaundice, hypoglycemia, hypothermia and respiratory distress syndrome.[1]

Premature cervical ripening, decidual activation and myometrial contractions have been linked to a variety of risk factors including uterine overdistension, cervical disease, uteroplacental disorders, infection and all has been linked to spontaneous preterm birth.[8-13] The difficulty in creating globally applicable guidelines to prevent, diagnose, and treat the clinical issue is explained by the variability of etiology in preterm birth. However, screening high-risk women who are asymptomatic is highly advised, and the most thoroughly studied methods include fetal fibronectin and cervical length measurements.[1] The current study set out to determine potential risk factors for preterm birth.

METHODS

This retrospective cohort study which is single center and hospital based was Diwaniyah Maternity Hospital, Diwaniyah province, Iraq from 1st January 2025 to 30th June 2025 during which records of women with single gestation for the last five years (January 2020 to January 2025) were retrieved and analyzed vide letter No. 92 dated 25-12-2024. After reviewing all reports of pregnant women admitted to Maternity Teaching Hospital, twin pregnancies and cases with abortion were excluded from study. The first case for each year of the five years of the study was selected based on a random number generated by the Microsoft Excel software and then Systematic random sample was applied by selecting every other 10 cases. Only women with singleton pregnancy who gave birth after 28 weeks gestation and ther age was in the range of 18 to 45 years were enrolled. At the end of the study, 428 cases of women with singleton pregnancy were enrolled.

The following information were retrieved form patient's records and were included in the study: about age, body mass index (BMI), level of education, residence, anemia, history of comorbidity, smoking, gravidity, history of abortion, history of preterm labor, history of contraception, history of antenatal care, presence of urinary tract infection, and level of vitamin D during pregnancy. The primary outcome was preterm birth which was considered when birth happens before completing 37 weeks of pregnancy.

The data was entered and analysed through SPSS-26. Student test was used to compare mean age and mean BMI between preterm and term groups. Chi-square and Fischer exact tests were used to compare proportions between preterm and term groups. Logistic regression analysis was used to adjust for confounders included in univariate analysis. Significance level was set at p value of ≤0.05.

RESULTS

Preterm delivery was reported in 44 (10.3%) is shown in figure 1. The range of age of participating women was between 18 and 45 years with the mean 27.15 ± 7.02 years (Table 1).

The univariate analysis after dividing the sample of pregnant women into 2 groups, term group (number of cases = 44) and preterm group (number of cases = 384). The following variables showed significant differences between preterm group and term group: age, body mass index (BMI), history of PTL and history of abortion ($p<0.001$). With respect to age, mean age of preterm group was higher significantly in comparison to mean age of term group, 26.49 years versus 32.86 years. We performed further analysis of age by categorizing women into 3 groups, <20 years, 20-40 years and >40 years (Table 2). Women less than 20 years of age experienced higher rate of preterm labor when compared to women between 20 and 40 years of age, 11.4% versus 4.6%, respectively. Regarding BMI, it was higher significantly in preterm group in comparison to term group, 27.64 kg/m^2 versus 23.20 kg/m^2 ($p<0.001$) and women with BMI >25 kg/m^2 (overweight or obese) experienced significantly higher rate of PTL in comparison to women with BMI <25 kg/m^2 (normal weight), 19% versus 5.9%, respectively ($p<0.001$). History of abortion was reported in 20.5% of preterm group compared to 0.5% of term group ($p<0.001$). In addition, history of PTL was reported in 27.3% of preterm group compared to 2.1 % of term group ($p<0.001$). Other variables showed no significant association with preterm labor ($p>0.05$) [Table 3].

Logistic regression analysis confirmed the findings of univariate analysis in that age, BMI, history of preterm and history of miscarriage are the significant predictors of PTL ($p<0.05$). A rise in age of one year is correlated to 1.14 higher risk of PTL (p <0.001). An increase of one kg/m^2 of BMI is correlated to 1.57 higher risk of PTL ($p<0.001$). History of abortion is correlated to 10.53 higher likelihood of preterm ($p = 0.003$) and history of PTL is correlated to 28.82 higher risk of preterm ($p = 0.003$) [Table 4].

Table No. 1: Results of univariate analysis

Characteristic		Preterm Group (n=44)	Term Group (n=384)	P value
Age (years)		32.86±10.45	26.49±6.21	<0.001***
Body mass index (kg/m^2)		27.64±5.03	23.20±2.43	<0.001***
Residence	Urban	34 (77.3%)	287 (74.7%)	0.713 N
	Rural	10 (22.7%)	97 (25.3%)	
Education	Illiterate	3 (6.8%)	24 (6.3%)	0.336 N
	Primary	15 (34.1%)	150 (39.1%)	
	Secondary	19 (43.2%)	180 (46.9%)	
	Tertiary	7 (15.9%)	30 (7.8%)	
Anemia	Yes	21 (47.7%)	191 (49.7%)	0.800 N
	No	23 (52.3%)	193 (50.3%)	

Comorbidity	Yes	3 (6.8%)	12 (3.1%)	0.192 N
	No	41 (93.2%)	372 (96.9%)	
Smoking	Yes	1 (2.3%)	10 (2.6%)	1.000 N
	No	43 (97.7%)	374 (97.4%)	
Gravidity	Nulliparous	9 (20.5%)	108 (28.1%)	0.280 N
	Multiparous	35 (79.5%)	276 (71.9%)	
History of abortion	Yes	12 (27.3%)	8 (2.1%)	<0.001***
	No	32 (72.7%)	376 (97.9%)	
History of PTL	Yes	9 (20.5%)	2 (0.5%)	<0.001***
	No	35 (79.5%)	382 (99.5%)	
History of contraception	Yes	2 (4.5%)	52 (13.5%)	0.089 N
	No	42 (95.5%)	332 (86.5%)	
ANC	Yes	43 (97.7%)	360 (93.8%)	0.496 N
	No	1 (2.3%)	24 (6.3%)	
UTI	Yes	22 (50%)	191 (49.7%)	0.974 N
	No	22 (50%)	193 (50.3%)	
Vitamin D deficiency	Yes	33 (75%)	304 (79.2%)	0.522 N
	No	11 (25%)	80 (20.8%)	

BMI: Body mass index; PTL: Preterm labor; ANC: Antenatal care; UTI: Urinary tract infection; N: not significant; ***Significant at p< 0.001

Table No. 2: The association between preterm labor and age of pregnant women

Age (years)	Preterm group (n=44	Term group (n=384)	P value
<20	8 (11.4%)	62 (88.6%)	<0.001 (Significant)
20-40	15 (4.6%)	313 (95.4%)	
>40	21 (70%)	9 (30%)	

Table No. 3: The association between preterm labor and body mass index (BMI) of pregnant women

Body mass index (kg/m^2)	Preterm group (n=44	Term group (n=384)	P value
Overweight and obese	27 (19.0%)	115 (81.1 %)	<0.001 (Significant)
Normal weight	17 (5.9%)	269 (94.1 %)	

Table No. 4: The logistic regression analysis which was carried out to find significant predictors of preterm labor

Variable	P value	OR	95 % (CI)
Age (years)	<0.001*	1.14	1.07 -1.21
BMI (kg/m2)	<0.001*	1.56	1.34 -1.82
Residence	0.463	0.66	0.22 -1.99
Education	0.742	0.90	0.50 -1.65
Anemia	0.625	0.80	0.33 -1.96
Comorbidity	0.844	0.82	0.12 -5.74
Smoking	0.918	0.88	0.08 -9.73
Gravidity	0.484	1.51	0.48 -4.78
History of Abortion	0.003*	10.53	2.27-48.84
History of PTL	0.001*	28.82	4.00 - 207.88
History of Contraception	0.07	0.08	0.01 -1.23
ANC	0.345	4.19	0.21 -81.89
UTI	0.147	2.00	0.79 -5.07
Vitamin D deficiency	0.469	0.69	0.25 -1.89

BMI: body mass index; PTL: preterm labor; ANC: antenatal care; UTI: urinary tract infection; *Significant p<0.05

DISCUSSION

In this study, we identify 4 main risk factors in association with PTL, namely age, BMI, previous abortion and previous PTL. Regarding age, majority of cases of PTL were seen when the age of women was >40 years. In addition, young females <20 years of age were also at higher likelihood of having PTL in comparison to women within 20-40 years of age. Fuchs et al[14] found that increased women age (greater than 40 years) was significantly correlated to higher risk of PTL and that women between 30 and 34 years of age were less likely to have PTL.

Our findings are consistent with two published cohort studies. In a group of Danish women, Lawlor et al[15] discovered a U-shaped correlation between risk of preterm birth and female age, with the lowest risk age

being between 24 and 30 years old. The threshold age for preterm birth in Finland, according to a more recent countrywide register-based cohort research, was 28 years old (OR 1.10, 1.02–1.19).[16] It is often believed that early labor induction for medical reasons accounts for a major portion of the increased risk of preterm birth among older moms.[14] However, in our study, all women with PTL experienced spontaneous PTL. Given our findings, we cannot rule out the possibility that, as McIntyre et al[17] and Fuchs et al[14] found in a population-based cohort research, advanced maternal age is independently linked to spontaneous preterm.

With respect to BMI, our findings suggest that overweight and obesity are associated with increased risk of PTL. Several previous studies have shown that BMI greater than 25 kg/m^2 is associated with higher risk of PTL in comparison with normal BMI (<25 kg/m^2).[18,19] Obesity and overweight are linked to a higher risk of gestational diabetes and hypertension[20,21], which are linked to a higher risk of planned caesarean section and/or induction of labor.

Regarding previous abortion, most previous articles deals with increased risk of PTL following induced abortion (not spontaneous abortion).[22] After one spontaneous abortion, the chance of preterm delivery rose, and after multiple spontaneous abortions, the risk increases even more.

Moreover, Agrawal et al[23] have shown in their study that spontaneous abortion is associated with increased risk of future PTTL. Regarding previous PTL, we have shown that patients with previous PTL are at higher risk of PTL in the future pregnancies. This finding is consistent with Iams and Berghella[24] who stated that preterm delivery is more likely to occur in subsequent pregnancies for women who gave birth to a child between 16 and 36 weeks of gestation and that the risk is inversely related to the gestational age of the prior preterm birth and rises with each further preterm birth.

It is recommended that women should complete their families before 40 years of age, and that women in their reproductive life should follow certain dietary measure and routine exercise to keep normal weight. In addition, women with previous repeated abortions and/ or PTL should be informed about the future risk of PTL and that avoiding pregnancy is encouraged if they have satisfactory family number, or at least to get treated in special PTL obstetric center during future pregnancy.

CONCLUSION

Advanced maternal age >40 years, high body mass index >25 kg/m^2, previous abortion and previous preterm labor are associated with increased likelihood of preterm labor.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Rana Hatem Matrood Alkhazraji
Drafting or Revising Critically:	Rana Hatem Matrood Alkhazraji
Final Approval of version:	The above author
Agreement to accountable for all aspects of work:	The above author

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Creswell L, Rolnik DL, Lindow SW, O'Gorman N. Preterm Birth: Screening and Prediction. Int J Womens Health 2023;15:1981-97.

2. Vidal MS Jr, Lintao RCV, Severino MEL, Tantengco OAG, Menon R. Spontaneous preterm birth: Involvement of multiple feto-maternal tissues and organ systems, differing mechanisms, and pathways. Front Endocrinol (Lausanne) 2022; 13:1015622.

3. Telayneh AT, Ketema DB, Mengist B, Yismaw L, Bazezew Y, Birhanu MY, Habtegiorgis SD. Pre-labor rupture of membranes and associated factors among pregnant women admitted to the maternity ward, Northwest Ethiopia. PLOS Glob Public Health 2023;3(3):e0001702.

4. Ohuma EO, Moller AB, Bradley E, Chakwera S, Hussain-Alkhateeb L, et al. National, regional, and global estimates of preterm birth in 2020, with trends from 2010: a systematic analysis. Lancet 2023;402(10409):1261-71.

5. WahhabJewad A. Risk Factors of Preterm Newborns in Al-Zahraa Hospital /Al Najaf Al Ashraf Province, Iraq 2017. Proceeding 2018; 4(1):e10558.

6. Howson CP, Kinney MV, Lawn JE. March of dimes, PMNCH, save the children, WHO. In: Born Too Soon: The Global Action Report on Preterm Birth. Geneva: World Health Organization; 2012.

7. Costeloe KL, Hennessy EM, Haider S, Stacey F, Marlow N, Draper ES. Short term outcomes after extreme preterm birth in England: comparison of two birth cohorts in 1995 and 2006 (the EPI Cure studies). BMJ 2012;345:e7976.

8. Romero R, Espinoza J, Kusanovic JP, Gotsch F, Hassan S, Erez O, Chaiworapongsa T, Mazor M. The preterm parturition syndrome. BJOG 2006;113 Suppl 3(Suppl 3):17-42.

9. Roman A, Suhag A, Berghella V. Overview of Cervical Insufficiency: Diagnosis, Etiologies, and Risk Factors. Clin Obstet Gynecol 2016;59(2): 237-40.

10. Chiu CPH, Feng Q, Chaemsaithong P, Sahota DS, Lau YY, Yeung YK, et al. Prediction of spontaneous preterm birth and preterm prelabor rupture of

membranes using maternal factors, obstetric history and biomarkers of placental function at 11-13 weeks. Ultrasound Obstet Gynecol 2022;60 (2):192-199.

11. Giorgione V, Quintero Mendez O, Pinas A, Ansley W, Thilaganathan B. Routine first-trimester pre-eclampsia screening and risk of preterm birth. Ultrasound Obstet Gynecol 2022;60(2):185-191.

12. Romero R, Espinoza J, Gonçalves LF, Kusanovic JP, Friel L, Hassan S. The role of inflammation and infection in preterm birth. SeminReprod Med 2007; 25(1):21-39.

13. Platt MJ. Outcomes in preterm infants. Public Health 2014;128(5):399-403.

14. Fuchs F, Monet B, Ducruet T, Chaillet N, Audibert F. Effect of maternal age on the risk of preterm birth: A large cohort study. PLoS One 2018; 13(1):e0191002.

15. Lawlor DA, Mortensen L, Andersen AM. Mechanisms underlying the associations of maternal age with adverse perinatal outcomes: a sibling study of 264 695 Danish women and their firstborn offspring. Int J Epidemiol 2011; 40(5):1205-14.

16. Klemetti R, Gissler M, Sainio S, Hemminki E. At what age does the risk for adverse maternal and infant outcomes increase? Nationwide register-based study on first births in Finland in 2005-2014. Acta Obstet Gynecol Scand 2016;95(12):1368-75.

17. McIntyre SH, Newburn-Cook CV, O'Brien B, Demianczuk NN. Effect of older maternal age on the risk of spontaneous preterm labor: a population-based study. Health Care Women Int 2009; 30(8):670-89.

18. Cornish RP, Magnus MC, Urhoj SK, Santorelli G, Smithers LG, et al. Maternal pre-pregnancy body mass index and risk of preterm birth: a collaboration using large routine health datasets. BMC Med 2024; 22(1):10.

19. Cornish RP, Magnus MC, Urhoj SK, Santorelli G, Smithers LG, Odd D, Fraser A, et al. Maternal pre-pregnancy body mass index and risk of preterm birth: a collaboration using large routine health datasets. BMC Med 2024;22(1):10.

20. Santos S, Voerman E, Amiano P, Barros H, Beilin LJ, Bergström A, et al. Impact of maternal body mass index and gestational weight gain on pregnancy complications: an individual participant data meta-analysis of European, North American and Australian cohorts. BJOG 2019;126(8):984-95.

21. Zong X, Wang H, Yang L, Guo Y, Zhao M, Magnussen CG, Xi B. Maternal Pre-pregnancy Body Mass Index Categories and Infant Birth Outcomes: A Population-Based Study of 9 Million Mother-Infant Pairs. Front Nutr 2022;9:789833.

22. Ke L, Lin W, Liu Y, Ou W, Lin Z. Association of induced abortion with preterm birth risk in first-time mothers. Sci Rep 2018;8(1):5353.

23. Agrawal S, Agrawal V, Suhane R. Pregnancy outcome following spontaneous abortions. Int J Reprod Contracept Obstet Gynecol 2017;4(6): 1891-3.

24. Iams JD, Berghella V. Care for women with prior preterm birth. Am J Obstet Gynecol 2010; 203(2):89-100.