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Association of Endometrial Thickness, Cervical Length, and Maternal Inflammatory Dermatoses With Preterm Birth in Pregnant Women: A Retrospective Clinical Study

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Owais Gill [1], Ayisha Ejaz Bhutta [2], Safia Ewaz Ali [3], Rameen Ali [4], Umaira Munir [5], Syeda Shaista Waheed [6], Arslan Shuja [7], Muhammad Nauman Shahid [8, 9]

1. Department of Radiology, PINUM Cancer Hospital, Faisalabad, PAK 2. Department of Obstetrics and Gynaecology, Kettering General Hospital, Kettering, GBR 3. Department of Obstetrics and Gynaecology, Unit I, Sandeman Provincial Hospital / Bolan Medical Complex Hospital (BMCH), Quetta, PAK 4. Department of Medical Sciences, Al-Aleem Medical College, Lahore, PAK 5. Department of Obstetrics and Gynaecology, Shahida Islam Medical College, Lodhran, PAK 6. Department of Obstetrics and Gynaecology, Nawaz Sharif Medical College, Gujrat, PAK 7. Institute of Molecular Biology and Biotechnology (IMBB) Centre for Research in Molecular Medicine (CRiMM), University of Lahore, Lahore, PAK 8. Department of Anatomy, Lahore Medical and Dental College, Lahore, PAK 9. Department of Biological Sciences, Lahore University of Biological and Applied Sciences, Lahore, PAK

Corresponding author: Arslan Shuja, arslanshuja1@gmail.com

Abstract

Background: Preterm birth contributes substantially to neonatal morbidity, but associations with inflammatory dermatoses and supplementary obstetric ultrasound markers remain uncertain.

Objective: To assess associations of maternal inflammatory dermatoses, cervical length, additional ultrasonographic markers, and preconception endometrial thickness with preterm birth.

Methods: This retrospective multicenter cohort included 170 singleton pregnancies from three Pakistani institutions (January 2025-May 2026). We analysed clinical, dermatological, ultrasound, and delivery records using adjusted logistic regression. Supplementary imaging variables were examined in separate exploratory models; preconception endometrial thickness was analysed only in women with documented measurements.

Results: Preterm birth occurred in 34 of 170 women (20.0%): 24 (70.6%) spontaneous and 10 (29.4%) medically indicated. Inflammatory dermatoses were present in 16 of 34 women (47.1%) delivering preterm versus 25 of 136 (18.4%) delivering at term. Adjusted associations were observed for inflammatory dermatoses (adjusted odds ratio (aOR) 2.83; 95% confidence interval (CI) 1.21-6.59), cervical length per 5-mm decrease (aOR 1.57; 95% CI 1.10-2.23), and amniotic fluid sludge (exploratory aOR 3.86; 95% CI 1.33-11.20). Preconception thickness was available for 52 women (30.6%) and was not significantly associated with preterm birth.

Conclusion: Recorded inflammatory dermatoses and shorter cervix were associated with preterm birth. Amniotic fluid sludge showed an exploratory association; limited events, missing imaging, and lack of validation preclude claims of clinical predictive utility.

Categories: Obstetrics/Gynecology, Radiology, Dermatology
Keywords: amniotic fluid sludge, cervical length, endometrial thickness, maternal inflammatory dermatoses, preterm birth, ultrasonography

Introduction

Preterm birth, defined as delivery before 37 completed weeks of gestation, is a leading contributor to neonatal mortality and morbidity; an estimated 13.4 million infants were born preterm worldwide in 2020 [1]. It has been linked to respiratory problems, neurological damage, neonatal infection, and length of stay in hospital. Its heterogeneous etiology is caused by multiple interacting pathways such as cervical remodeling, maternal and intra-amniotic inflammation, and uteroplacental dysfunction [2,3]. Important maternal and sonographic associations need to be identified for understanding the risk of preterm birth.

Transvaginal ultrasonography is a proven technique for measuring cervical length in the midtrimester, and a cervical length of ≤25 mm is a significant risk factor in certain singleton pregnancies [2,4,5]. Cervical length is usually assessed as a continuous variable, and its dichotomization at 25 mm may mask relationships across the range. Additional sonographic findings of interest include cervical funneling, anterior uterocervical angle, amniotic fluid sludge, placental thickness, and uterine artery Doppler pulsatility index. These measurements reflect different aspects of cervical morphology, possible intra-amniotic inflammation, and placental or uteroplacental physiology. Their associations with preterm birth, beyond established

cervical and maternal factors, remain uncertain [5-10].

Maternal inflammatory dermatoses, particularly psoriasis and atopic dermatitis, are characterized by altered cutaneous and, in some patients, systemic inflammatory signaling. Cytokine-mediated inflammation has a biologically plausible connection to decidual activation, cervical remodeling, and pathways implicated in spontaneous preterm labor [3,11-13]. Nevertheless, epidemiological findings vary: some studies associate psoriasis-especially more severe disease-with adverse obstetric outcomes, whereas others report no overall association with preterm birth [11,12]. Evidence concerning atopic dermatitis is likewise heterogeneous [13]. Variation in disease severity, treatment exposure, ascertainment, and maternal comorbidity may partly explain these differences; these factors should be considered when interpreting observational associations.

Preconception endometrial thickness is assessed by transvaginal ultrasonography, most often during infertility evaluation, and may be influenced by the menstrual-cycle phase, hormonal exposure, and mode of conception [14]. It is not the same as the decidualized endometrium of an established pregnancy and needs to be assessed only in examinations done before conception. It is not known if a pre-conception thickness measurement is related to subsequent preterm birth. Interpretation requires attention to the timing and clinical indication for the original ultrasound, particularly when measurements are available for only a selected subgroup [14].

Few studies have evaluated maternal inflammatory dermatoses together with established cervical measurements and supplementary obstetric imaging variables in one retrospective cohort. The primary objective of this study was to estimate associations of documented inflammatory dermatoses and midtrimester cervical length with preterm birth, accounting for maternal age and previous preterm birth. Secondary objectives were to describe associations for cervical funneling, anterior uterocervical angle, amniotic fluid sludge, placental thickness, and uterine artery Doppler pulsatility index; to examine preconception endometrial thickness in the subset with available measurements; and to assess spontaneous preterm birth separately. The study evaluated associations, not the development or validation of a clinical prediction tool.

Materials And Methods

Study design and setting

This retrospective multicenter study analyzed 170 singleton pregnancies with available records from January 2025 to May 2026 at Obstetrics and Gynaecology Unit I, Sandeman Provincial Hospital, Quetta; Al-Aleem Medical College, Lahore; and Ghurki Trust Teaching Hospital (affiliated with Lahore University of Biological and Applied Sciences), Lahore, Pakistan. Existing obstetric, dermatological, and imaging documentation was examined without study-directed clinical interventions. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [15]. Complete screening counts and information regarding consecutive participant selection were unavailable.

Study population and eligibility criteria

To be eligible, they had to be ≥18 years old, carrying a singleton pregnancy, have reliable gestational-age dating, have had an antenatal assessment documented, have maternal dermatological information, have a midtrimester measurement of the cervical length, and have a delivery outcome available. Women who had more than one pregnancy, major fetal congenital anomalies, uterine malformations, or incomplete delivery records were excluded (Table *1*). All 170 pregnancies in the analytic cohort fulfilled these criteria. Institution-specific screening and exclusion counts were unavailable, limiting assessment of participant selection and case capture. Preconception endometrial thickness was not an inclusion requirement and was assessed only in the 52 participants with documented preconception examinations. Figure *1* shows the distribution of pregnancy outcomes among the 170 women included in the study, categorizing deliveries as term or preterm, with preterm births further classified as spontaneous or medically indicated.

Eligibility category	Criterion
Inclusion	Maternal age ≥18 years
Inclusion	Singleton pregnancy
Inclusion	Documented antenatal assessment
Inclusion	Available delivery outcome
Inclusion	Reliable gestational-age dating
Inclusion	Available maternal dermatological information
Inclusion	Available midtrimester cervical length measurement
Exclusion	Multiple gestation
Exclusion	Major fetal congenital abnormality
Exclusion	Uterine malformation
Exclusion	Incomplete delivery records

TABLE 1: Inclusion and Exclusion Criteria for the Retrospective Cohort (N=170)

Assessment of gynecological and obstetric status

Maternal age, body mass index, gravidity, parity, previous preterm birth, menstrual and reproductive history, method of conception, and recorded obstetric complications were reviewed. Gestational age was determined using early-pregnancy ultrasonography or the documented obstetric estimate, although the dating hierarchy was not standardized across participating centers. Assisted reproductive conception was considered in the preconception endometrial-thickness subgroup analysis. The primary adjusted model included maternal age and prior preterm birth as selected clinical covariates.

Dermatological assessment

Inflammatory dermatoses were categorized according to a documented physician diagnosis of psoriasis or atopic dermatitis before the index midtrimester cervical assessment. Infectious skin disorders, isolated irritation, and nonspecific pruritus were not classified as inflammatory dermatoses. Available dermatological documentation described disease type and, when recorded, duration, severity, and treatment history. Specialist confirmation, disease severity assessment, and treatment documentation varied across participants. The primary analysis therefore used a binary documented-diagnosis exposure, while disease-specific comparisons were exploratory. Variable clinical ascertainment may have produced exposure misclassification and residual confounding.

Radiological and ultrasonographic assessment

Imaging exposures comprised midtrimester cervical length, cervical funneling, anterior uterocervical angle, amniotic fluid sludge, placental thickness, and mean uterine artery Doppler pulsatility index (PI). Preconception endometrial thickness was considered separately. It was recorded in millimeters from a transvaginal examination before the index pregnancy as the maximal double-layer thickness in the midsagittal uterine plane. These measurements were not interchangeable with measurements during an established pregnancy. The preconception imaging documentation did not establish comparable menstrual-cycle phases, scan indications, or hormonal conditions across the 52 women with available measurements, limiting between-patient comparability.

Midtrimester cervical length was assessed transvaginally at 18+0 to 23+6 weeks of gestation, analyzed as a continuous variable, and also categorized descriptively at ⩽25 mm. Cervical funneling referred to internal-os opening with membrane protrusion; the anterior uterocervical angle was measured between the cervical canal and the anterior lower uterine segment. Amniotic fluid sludge was defined as particulate echogenic material near the internal cervical os. Placental thickness was assessed transabdominally, while mean uterine artery Doppler PI was determined from bilateral measurements when documented. Measurements were obtained from recorded ultrasound findings or assessable archived imaging. Incomplete documentation of equipment specifications, acquisition protocols, and interobserver reliability limited assessment of measurement consistency across centers.

Outcome assessment

The primary outcome was delivery prior to 37 completed weeks of gestation - any preterm delivery, irrespective of indication for delivery (spontaneous or medically indicated delivery), as both types of delivery contributed to the observed cohort outcome. The definitions used were "term birth" as delivery at or after 37 weeks. Of the 34 preterm births, 24 were deemed to be spontaneous, and 10 were medically indicated based on the obstetric record. To be able to analyze the secondary analysis, medically indicated preterm births were excluded to look at the spontaneous phenotype. Also described were gestational age at delivery and birth before 34 weeks. When interpreting the pooled primary analysis, different etiologies for spontaneous and medically indicated preterm birth were used.

Statistical analysis

For continuous variables, data were expressed as mean ± standard deviation (SD) or median (interquartile range), and for categorical data as number (percentage). Welch's t-test, Mann-Whitney U test, or Fisher's exact test were used for between-group comparisons as appropriate. Study-center distributions were compared using Pearson's chi-square test, with degrees of freedom and Cramér's V. The primary logistic regression included recorded inflammatory dermatoses, cervical length per 5-mm decrease, maternal age per 5-year increase, and previous preterm birth. These four variables represented the two study exposures plus clinically relevant maternal covariates. With 34 preterm-birth events, the model had 8.5 events per parameter, indicating limited precision and potential overfitting [16]. Supplementary ultrasonographic markers were assessed one at a time in separate models adjusting for these same four covariates. In the 52-woman preconception-imaging subgroup (11 preterm births), the endometrial-thickness model adjusted for maternal age and assisted reproductive conception. Variables with incomplete measurements were analyzed using available-case denominators. The analysis documentation did not specify an imputation procedure. Multivariable logistic regression was performed without adjustment for study center, and potential center-related confounding was considered when interpreting the findings. Adjusted odds ratios (aORs), 95% confidence intervals (CIs), and two-sided p-values were calculated. Statistical significance was defined as $p<0.05$, without adjustment for multiple comparisons in exploratory analyses. The receiver operating characteristic (ROC) curve area under the curve (AUROC) was calculated and interpreted descriptively in the study cohort. No model calibration, optimization, or internal or external validation was done [17]. Discriminatory performance was not compared between models with and without maternal inflammatory dermatoses, and incremental predictive utility was not assessed.

Ethical considerations

This retrospective study involved the review and analysis of existing maternal clinical records and ultrasonographic data without any additional patient interventions. Ethical approval was obtained under reference number ERC/2024/0037D. Patient confidentiality was maintained through data de-identification, secure handling of clinical records, and reporting of results in aggregate form to protect participants' privacy and anonymity.

Results

Maternal demographic and obstetric characteristics

The analysis included 170 women, of whom 136 (80.0%) delivered at term and 34 (20.0%) delivered preterm. Among the 34 preterm births, 24 (70.6%) occurred spontaneously, and 10 (29.4%) were medically indicated; 14 of 170 women (8.2%) delivered before 34 gestational weeks. Mean gestational age at delivery was 33.86 ± 2.28 weeks in the preterm group and 38.91 ± 0.80 weeks in the term group ($p<0.001$). Figure *1* illustrates the distribution of pregnancy outcomes among the 170 women included in the study.

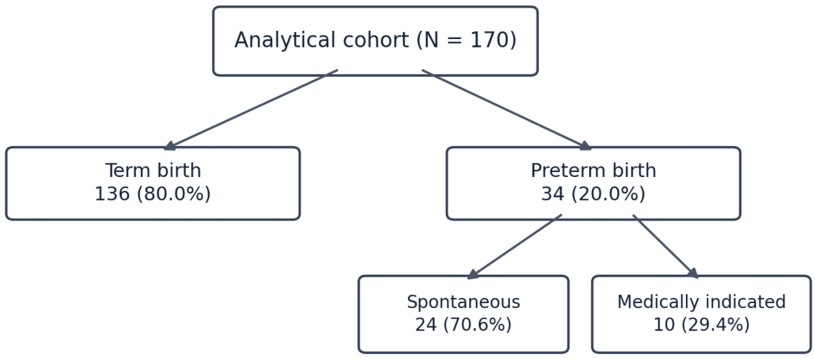

FIGURE 1: Pregnancy outcome classification within the current study cohort (N=170)

Mean maternal age was 31.08 ± 4.84 years in the preterm group and 29.48 ± 4.62 years in the term group (p=0.088). Previous preterm birth was documented in 4 of 34 (11.8%) and 10 of 136 women (7.4%), respectively. Body mass index, parity, and assisted reproductive conception did not differ significantly between groups. The observed distribution of outcomes across the three centers did not reach statistical significance (Pearson $\chi^2(2, N=170)=4.151$; p=0.125; Cramér's V=0.156); this descriptive comparison does not exclude center-related confounding. Baseline characteristics are presented in Table *2*.

Characteristics	Term birth (n=136)	Preterm birth (n=34)	p-value
Maternal age, years	29.48 ± 4.62	31.08 ± 4.84	0.088
BMI, kg/m²	26.64 ± 4.11	27.28 ± 4.04	0.414
Nulliparity	53 (39.0%)	13 (38.2%)	1
Previous preterm birth	10 (7.4%)	4 (11.8%)	0.483
Assisted reproductive conception	19 (14.0%)	5 (14.7%)	1
Study center			0.125
Sandeman Provincial Hospital, Quetta	52 (38.2%)	7 (20.6%)	—
Al-Aleem Medical College, Lahore	38 (27.9%)	14 (41.2%)	—
Ghurki Trust Teaching Hospital, Lahore	46 (33.8%)	13 (38.2%)	—
Gestational age at delivery, weeks	38.91 ± 0.80	33.86 ± 2.28	<0.001

TABLE 2: Baseline Maternal and Obstetric Characteristics According to Pregnancy Outcome (N=170)

Values are mean ± SD or n (%). BMI: body mass index. Continuous variables were compared using Welch's t-test, categorical variables using Fisher's exact test, and study-center distribution using Pearson's chi-square test ($\chi^2[2, N=170]=4.151$; p=0.125; Cramér's V=0.156). Percentages are within pregnancy-outcome groups; the p-values are unadjusted.

Association of maternal inflammatory dermatoses with preterm birth

Recorded inflammatory dermatoses were present in 41 of 170 women (24.1%): 22 (12.9%) had psoriasis, and 19 (11.2%) had atopic dermatitis. Preterm birth occurred in 16 of 41 women with inflammatory dermatoses (39.0%), compared with 18 of 129 without these diagnoses (14.0%). These are descriptive event proportions rather than adjusted risks.

Inflammatory dermatoses were documented in 16 of 34 women (47.1%) with preterm birth versus 25 of 136 (18.4%) with term birth (Fisher's exact p=0.001). Atopic dermatitis was documented in 8 of 34 (23.5%) versus 11 of 136 (8.1%; p=0.028), whereas psoriasis was documented in 8 of 34 (23.5%) versus 14 of 136 (10.3%; p=0.049). These disease-specific findings are unadjusted, exploratory comparisons; small subgroup sizes, overlapping clinical characteristics, and unavailable severity or treatment information limit interpretation.

Cervical length and additional radiological biomarkers

Mean midtrimester cervical length was shorter in women with preterm delivery than in those delivering at term (30.92 ± 5.57 vs. 34.73 ± 6.32 mm; p=0.001). Thirteen women (7.6% of 170) had a cervical length ⩽25 mm, including 5 of 34 preterm births (14.7%) and 8 of 136 term births (5.9%). The categorical ⩽25-mm comparison was not statistically significant (Fisher's exact p=0.139), despite the significant continuous-length comparison. The small number of women below the threshold limited statistical power, and the categorical analysis did not establish a significant threshold association.

Cervical funneling was present in 10 of 34 women with preterm birth (29.4%) and 17 of 134 with term birth (12.7%; p=0.033). Amniotic fluid sludge was documented in 8 of 33 (24.2%) and 14 of 132 (10.6%), respectively (p=0.049). These unadjusted comparisons used different available-case denominators and were considered separately from the adjusted exploratory estimates.

The mean anterior uterocervical angle was 102.93 ± 12.33° among women with preterm birth and 101.04 ± 11.35° among women with term birth (p=0.435). Placental thickness and uterine artery Doppler PI did not show statistically significant between-group differences. Preconception endometrial thickness was documented for 52 of 170 women (30.6%; unavailable in 118, 69.4%), including 11 with subsequent preterm birth and 41 with term birth. Mean preconception thickness was 9.53 ± 1.68 versus 10.22 ± 2.06 mm, respectively (p=0.265). These measurements applied to a selected minority of participants, without established comparability of menstrual-cycle phase, and cannot be generalized to the full cohort. Table *3* provides available-case denominators for the dermatological and imaging comparisons.

Parameter	Term birth (n=136)	Preterm birth (n=34)	p-value
Dermatological characteristics			
Any inflammatory dermatosis	25 (18.4%)	16 (47.1%)	0.001
Atopic dermatitis	11 (8.1%)	8 (23.5%)	0.028
Psoriasis	14 (10.3%)	8 (23.5%)	0.049
Radiological characteristics			
Cervical length, mm	34.73 ± 6.32	30.92 ± 5.57	0.001
Cervical length ≤25 mm	8 (5.9%)	5 (14.7%)	0.139
Cervical funneling	17/134 (12.7%)	10/34 (29.4%)	0.033
Anterior uterocervical angle, degrees	101.04 ± 11.35 (n=128)	102.93 ± 12.33 (n=32)	0.435
Amniotic fluid sludge	14/132 (10.6%)	8/33 (24.2%)	0.049
Placental thickness, mm	23.30 ± 3.35 (n=133)	24.32 ± 3.72 (n=32)	0.163
Uterine artery Doppler PI	1.09 ± 0.24 (n=120)	1.10 ± 0.24 (n=30)	0.839
Preconception endometrial thickness, mm	10.22 ± 2.06 (n=41)	9.53 ± 1.68 (n=11)	0.265

TABLE 3: Maternal Inflammatory Dermatoses and Radiological Biomarkers According to Pregnancy Outcome

Values are mean ± SD or n (%) and use available observations; denominators are shown for incomplete measurements. PI: pulsatility index. P-values are unadjusted (Welch's t-test or Fisher's exact test). Available measurements were as follows: cervical funneling, 168/170; uterocervical angle, 160/170; amniotic fluid sludge, 165/170; placental thickness, 165/170; uterine artery Doppler PI, 150/170; and preconception endometrial thickness, 52/170. The respective unavailable counts were 2, 10, 5, 5, 20, and 118.

Primary adjusted associations with preterm birth

In the four-covariate logistic regression model adjusting for maternal age and previous preterm birth, inflammatory dermatoses were associated with higher odds of preterm delivery (aOR 2.83; 95% CI 1.21-6.59;

p=0.016). Each 5-mm decrease in midtrimester cervical length was also associated with higher adjusted odds of preterm birth (aOR 1.57; 95% CI 1.10-2.23; p=0.013). The estimate describes a decrease in the continuous cervical-length measure, not an effect of the ⩽25-mm categorical threshold. These findings are observational associations and do not establish causation.

Maternal age per 5-year increase (aOR 1.43; 95% CI 0.92-2.22; p=0.115) and prior preterm birth (aOR 1.46; 95% CI 0.38-5.64; p=0.580) were not statistically significant in this model. The apparent AUROC of the fitted model was 0.729 on the same sample used for model estimation. The AUROC estimate did not have a confidence interval, optimism correction, calibration assessment, or internal/external validation. Thus, the AUROC does not provide validated discrimination or clinical prediction utility. The coefficient estimates are summarized in Table *4*.

Predictor	Adjusted OR (aOR)	95% CI	p-value
Maternal inflammatory dermatoses	2.83	1.21–6.59	0.016
Cervical length, per 5-mm decrease	1.57	1.10–2.23	0.013
Maternal age, per 5-year increase	1.43	0.92–2.22	0.115
Previous preterm birth	1.46	0.38–5.64	0.58

TABLE 4: Multivariable Logistic Regression Analysis of Factors Associated With Preterm Birth (N=170)

aOR: adjusted odds ratio; CI: confidence interval; AUROC: area under the receiver operating characteristic curve. The model included all four listed covariates and 34 preterm birth events among 170 pregnancies. Reference categories were absence of inflammatory dermatoses and no previous preterm birth. Apparent, training-sample AUROC=0.729 (without an accompanying confidence interval or calibration assessment)

Exploratory adjusted associations of additional imaging markers

Each supplementary ultrasonographic marker was evaluated in a separate exploratory logistic regression model adjusting for maternal age, previous preterm birth, inflammatory dermatoses, and continuous cervical length. Amniotic fluid sludge was associated with preterm birth in its available-case model (n=165; aOR 3.86; 95% CI 1.33-11.20; p=0.013). Cervical funneling showed an elevated but statistically uncertain adjusted estimate (n=168; aOR 2.63; 95% CI 0.95-7.30; p=0.063). These associations do not establish the diagnostic accuracy, causal role, or added predictive value of either imaging feature.

Anterior uterocervical angle (per 10° increase: aOR 1.09; 95% CI 0.76-1.57; p=0.636), placental thickness (per 5-mm increase: aOR 1.44; 95% CI 0.76-2.73; p=0.265), and mean uterine artery Doppler PI (per 0.2-unit increase: aOR 1.07; 95% CI 0.73-1.56; p=0.730) were not statistically significant after adjustment. The estimates were obtained in separate models with different analytic sample sizes; lack of statistical significance should not be interpreted as evidence that an association is absent.

In the selected preconception-imaging subgroup (n=52; 11 preterm events), endometrial thickness per 1-mm increase was not statistically significantly associated with preterm birth after adjustment for maternal age and assisted reproductive conception (aOR 0.75; 95% CI 0.50-1.13; p=0.167). The small number of outcome events and limited comparability of preconception measurements make this estimate particularly imprecise. Table *5* summarizes all separate exploratory adjusted models.

Radiological biomarker	n	Adjusted OR (aOR)	95% CI	p-value
Cervical funneling	168	2.63	0.95–7.30	0.063
Amniotic fluid sludge	165	3.86	1.33–11.20	0.013
Uterocervical angle, per 10° increase	160	1.09	0.76–1.57	0.636
Placental thickness, per 5-mm increase	165	1.44	0.76–2.73	0.265
Uterine artery PI, per 0.2-unit increase	150	1.07	0.73–1.56	0.73
Preconception endometrial thickness, per 1-mm increase	52	0.75	0.50–1.13	0.167

TABLE 5: Exploratory Adjusted Associations of Additional Radiological Biomarkers With Preterm Birth

aOR: adjusted odds ratio; CI: 95% confidence interval; PI: pulsatility index. The first five variables were tested individually in separate models, each adjusted for maternal age, previous preterm birth, inflammatory dermatoses, and continuous cervical length. The preconception endometrial-thickness model was adjusted only for maternal age and assisted reproductive conception. All models used available cases for their respective markers; the corresponding n is shown. The endometrial subgroup had 11 preterm events among 52 women.

Descriptive cross-classification of inflammatory dermatoses and cervical shortening

The rate of preterm birth was 13.2% (16 of 121) in women with neither inflammatory dermatoses nor cervical shortening ⩽25 mm; 36.1% (13 of 36) in women with inflammatory dermatoses only; and 25.0% (2 of 8) in women with cervical shortening only. These are unadjusted proportions and are not representative of the amount of interaction between exposures.

Among the five women with both inflammatory dermatoses and cervical shortening, three experienced preterm birth (3/5; 60.0%). This is a very small cell size (2.9% of the total cohort) and gives rise to an unstable descriptive proportion. An additive or synergistic effect cannot be inferred, as no formal interaction term or interaction effect was estimated. These data are only descriptively cross-classified in Table *6*.

Maternal inflammatory dermatoses	Cervical length	Total, n (%)	Term birth, n (%)	Preterm birth, n (%)
Absent	>25 mm	121 (71.2)	105 (86.8)	16 (13.2)
Present	>25 mm	36 (21.2)	23 (63.9)	13 (36.1)
Absent	≤25 mm	8 (4.7)	6 (75.0)	2 (25.0)
Present	≤25 mm	5 (2.9)	2 (40.0)	3 (60.0)
Total		170 (100.0)	136 (80.0)	34 (20.0)

TABLE 6: Combined Association of Maternal Inflammatory Dermatoses and Cervical Shortening with Preterm Birth (N=170)

Data are n (%) with term/preterm percentages calculated within each exposure row; overall-group percentages use N=170. Short cervix was defined as cervical length ≤25 mm. The group with both characteristics contained only five women; cross-classification is descriptive, with no interaction analysis or clinically actionable combined-risk estimate.

Secondary analysis of spontaneous preterm birth

To examine whether the primary associations were driven by the inclusion of medically indicated preterm deliveries, a secondary analysis excluded 10 of the 34 preterm births (29.4%), leaving 160 pregnancies: 24 (15.0%) spontaneous preterm births and 136 (85.0%) term births. In the secondary multivariable logistic regression model, inflammatory dermatoses and cervical length were evaluated with adjustment for maternal age and previous preterm birth.

Inflammatory dermatoses were associated with spontaneous preterm birth (aOR 2.75; 95% CI 1.06-7.14; p=0.038), as was each 5-mm decrease in cervical length (aOR 1.54; 95% CI 1.03-2.30; p=0.036). Both

estimates were in the same direction as those from the primary all-preterm-birth analysis; the data do not permit a causal interpretation. Because the secondary model included only 24 outcome events, its confidence intervals are wide and residual confounding cannot be excluded, as shown in Table 7.

Predictor	Adjusted OR (aOR)	95% CI	p-value
Maternal inflammatory dermatoses	2.75	1.06–7.14	0.038
Cervical length, per 5-mm decrease	1.54	1.03–2.30	0.036

TABLE 7: Secondary Multivariable Logistic Regression Analysis of Factors Associated With Spontaneous Preterm Birth (N=160)

aOR: adjusted odds ratio; CI: 95% confidence interval. The analytic subset comprised 24 spontaneous preterm deliveries and 136 term deliveries (N=160), after exclusion of 10 medically indicated preterm deliveries. Both estimates were adjusted for maternal age and previous preterm birth in addition to the two displayed exposure variables. Small event counts limit precision and model stability.

In summary, the primary models showed adjusted associations between preterm birth and recorded inflammatory dermatoses and shorter continuous cervical length. Amniotic fluid sludge showed an additional exploratory adjusted association. These analyses do not establish whether supplementary markers improve the predictive performance of a cervical-length-based model.

The descriptive 60.0% preterm-birth proportion among women with both inflammatory dermatoses and cervical shortening was based on only three events in five women; this subgroup was too small to support inferences about interaction or inform clinical management. The associations within the spontaneous-preterm-birth subset had similar directions to the primary analysis but were less precise. Interpretation is limited across the exploratory comparisons due to incomplete measurement availability and lack of formal incremental-performance testing.

Discussion

A multicenter, retrospective cohort of 170 singleton pregnancies found that maternal inflammatory dermatoses and short midtrimester cervical length were associated with preterm birth, even after accounting for maternal age and prior history of preterm birth. A total of 16 out of 41 women (39.0%) in the inflammatory dermatoses group had preterm delivery compared to 18 out of 129 (14.0%) women in the non-inflammatory dermatoses group. In a separate exploratory model, amniotic fluid sludge was also associated with preterm birth, but it was not evaluated whether this marker added to the model performance of cervical length. Given the small number of events, the observational design, and the heterogeneity of the records, the estimates of effects should be interpreted with caution [15,16].

A 5-mm decrease in continuous cervical length was associated with 57% higher adjusted odds of preterm delivery (aOR 1.57; 95% CI 1.10-2.23). This is similar to previous reports revealing that the shortening of the cervix is linked to spontaneous preterm birth [2,4,5]. The categorical comparison at the cut-off of ⩽25 mm was, however, not statistically significant (5/34 versus 8/136; p=0.139), likely due to the small number of patients in this category. The continuous and categorical cervical-length analyses examined distinct statistical relationships, accounting for differences in their observed statistical significance. The spontaneous-preterm-birth sensitivity analysis showed a directionally similar association (aOR 1.54; 95% CI 1.03-2.30).

Maternal inflammatory dermatoses were associated with preterm birth (aOR 2.83; 95% CI 1.21-6.59), but causality cannot be inferred. Psoriasis and atopic dermatitis involve inflammatory signaling that could plausibly intersect with pathways of cervical and decidual activation [3,11-13]. Previous population-based studies have reported differing results: Bröms et al. identified associations between maternal psoriasis and adverse pregnancy outcomes [11], whereas Johansen et al. did not identify an overall psoriasis-preterm-birth association [12]. Differences in disease severity, systemic treatment, comorbidity profiles, disease ascertainment, and maternal characteristics may contribute to heterogeneous results. In the present study, severity and systemic treatment were not analyzed as covariates, and ascertainment relied on recorded diagnoses rather than uniformly repeated dermatological examinations. The observed 3/5 preterm births among women with both dermatoses and cervical shortening are descriptive only; this cell is far too small for reliable inference about combined effects or interaction .

Amniotic fluid sludge was recorded in 8 of 33 preterm deliveries (24.2%) and 14 of 132 term deliveries (10.6%); it was associated with preterm birth in an exploratory adjusted model (aOR 3.86; 95% CI 1.33-11.20). Prior literature has linked sonographic sludge with intra-amniotic inflammatory or infectious processes and adverse pregnancy outcomes, although the finding is not specific for infection [6,10]. Because

this was a retrospective association analysis without calibration, external validation, or a comparison of model performance with and without sludge, its incremental predictive accuracy and clinical utility remain unproven. Cervical funneling was more frequent in the preterm group on unadjusted comparison but not statistically significant after adjustment (aOR 2.63; 95% CI 0.95-7.30). Uterocervical angle, placental thickness, and uterine artery Doppler PI also did not show statistically significant adjusted associations. These null tests do not establish that the markers have no role, particularly given variable measurement availability and potential differences between spontaneous and medically indicated preterm births [5,7,8].

Preconception endometrial thickness was available in only 52 of 170 pregnancies (30.6%), including 11 preterm births. The adjusted estimate (aOR 0.75 per 1-mm increase, 95% CI 0.50 to 1.13, p=0.167) was imprecise and did not suggest an association with later preterm delivery. Notably, preconception scans might have been performed for reproductive reasons, and endometrial thickness varies depending on menstrual-cycle phase, hormone exposure, and method of conception [14]. The preconception imaging records were not able to confirm similar menstrual-cycle phases of the 52 women with measurements, or to compare them extensively with the 118 women without measurements. Selection and measurement heterogeneity are therefore a limitation for interpretation; lack of statistical significance should not be interpreted as lack of a biological association [14,15].

This multicenter study used clinical dermatology records, obstetric measurements, and radiological measurements, and examined spontaneous preterm birth separately. However, it is a retrospective study, which makes it difficult to infer causality and leaves the possibility of selection bias and residual confounding [15]. Case capture was not fully assessed due to the lack of a complete screening denominator, information on center-level recruitment, and confirmation of consecutive inclusion. This report did not include information on equipment specifications, standardized acquisition protocols, retrospective rereading procedures, and interobserver reliability estimates. Dermatologic diagnosis relied on the documentation of clinical findings and was not standardized, and disease severity, treatment, and significant maternal conditions were not fully documented. The number of primary outcome events was only 34 for a four-parameter model, and exploratory models included five imaging variables, with the potential for imprecise estimates and overfitting [16]. Multiple tests were performed without adjustment, and the center was not included in the regression models. The apparent in-sample AUROC was 0.729, and no confidence interval, calibration assessment, optimism correction, internal or external validation, or model comparison with or without dermatoses was performed. Thus, neither incremental predictive value nor clinical utility was demonstrated. For endometrial thickness, just 52 women (30.6%) had preconception data and only 11 experienced preterm birth; variation in menstrual-cycle phase, scan indication, and hormonal treatment could not be accounted for. Nonrandom missing measurements and regional variation in case mix further limit generalizability. Larger prospective studies with transparent participant selection, standardized imaging and dermatological assessment, comprehensive confounder measurement, and validated incremental prediction analyses are needed [5,15-17].

Conclusions

In this multicenter retrospective cohort, recorded maternal inflammatory dermatoses and shorter midtrimester cervical length were associated with greater odds of preterm delivery after adjustment for selected maternal factors. Amniotic fluid sludge also showed an exploratory adjusted association; the other evaluated imaging variables and preconception endometrial thickness did not show statistically significant adjusted associations in their respective analyses. The 3/5 preterm-birth observation among women with both dermatoses and cervical shortening was based on an extremely small subgroup and does not establish interaction. These results are hypothesis-generating associations, not evidence of causal effects, improved prediction, or clinical utility. Larger studies with standardized imaging and dermatological assessment, explicit sampling methods, and external validation are required.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Arslan Shuja, Owais Gill, Ayisha Ejaz Bhutta, Safia Ewaz Ali, Rameen Ali, Syeda Shaista Waheed, Umaira Munir, Muhammad Nauman Shahid

Acquisition, analysis, or interpretation of data: Arslan Shuja, Owais Gill, Ayisha Ejaz Bhutta, Safia Ewaz Ali, Rameen Ali, Syeda Shaista Waheed, Umaira Munir, Muhammad Nauman Shahid

Drafting of the manuscript: Arslan Shuja, Owais Gill, Ayisha Ejaz Bhutta, Safia Ewaz Ali, Rameen Ali, Syeda Shaista Waheed, Umaira Munir, Muhammad Nauman Shahid

Critical review of the manuscript for important intellectual content: Arslan Shuja, Owais Gill, Ayisha Ejaz Bhutta, Safia Ewaz Ali, Rameen Ali, Syeda Shaista Waheed, Umaira Munir, Muhammad Nauman Shahid

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Lahore University of Biological and Applied Sciences (Lahore-UBAS) issued approval ERC/2024/0037D. This retrospective study involved the review and analysis of existing maternal clinical records and ultrasonographic data without any additional patient interventions. Ethical approval was obtained under reference number ERC/2024/0037D. Patient confidentiality was maintained through data de-identification, secure handling of clinical records, and reporting of results in aggregate form to protect participants' privacy and anonymity. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **AI use statement:** The authors have declared that no AI tools were used during the work or in the drafting of this article. The authors take full responsibility for the work. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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