E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/16.02.861

Research Article

Efficacy of Vaginal Versus Oral Progesterone in Preventing Preterm Birth among Low-Risk Women with a Short Cervix Diagnosed At 20–24 Weeks

Iqra Khalid[1], Wadduha Amin[2], Shamas Un Nisa[3], Irum Ibrahim[4], Sana Nafees[5], Shamim Akhtar[6*]
[1]FCPS Obstetrics & Gynecology, Reproductive Health Consultant at Ipas Pakistan.
[2]House Officer, Department of Obstetrics and Gynaecology, Peshawar Medical College, Peshawar, Pakistan.
[3]Associate Professor, Department of Obstetrics & Gynecology, Unit 2 BVH/QAMC BWP, Bahawal Victoria Hospital, Bahawalpur, Pakistan.
[4]Head of Gynaecology Department, Category C Hospital, Tangi District, Charsadda, Pakistan.
[5]Senior Registrar, Department of Obstetrics and Gynaecology, Peshawar Medical College, Peshawar, Pakistan.
[6*]Associate Professor, Department of Obstetrics and Gynaecology, Kuwait Teaching Hospital & Peshawar Medical College, Peshawar, Pakistan.
Corresponding author: Dr Shamim Akhtar
Associate Professor, Department of Obstetrics and Gynaecology, Kuwait Teaching Hospital & Peshawar Medical College, Peshawar, Pakistan.
Email: drshamim67@yahoo.com
Received: 24.08.2026, Revised: 16.10.2026, Accepted: 23.10.2026

ABSTRACT
Introduction: Vaginal progesterone is a proven preventive treatment for women with a short cervix, and a short cervix is an important cause of neonatal morbidity and mortality. There is limited evidence to compare the vaginal and oral routes.
Objective: To evaluate the effectiveness of vaginal and oral progesterone for the prevention of preterm birth in low-risk singleton pregnancies with a sonographically short cervix at 20-24 weeks.
Methods: This is a prospective randomized controlled study carried out at the Department of Obstetrics and Gynaecology, Peshawar Medical College, in the duration from February, 2026 to July, 2026. One hundred and twenty women who had cervical length ≤25 mm were consecutively recruited and randomly assigned to the vaginal (n=60) or oral (n=60) micronized progesterone 200 mg daily until 36 weeks or delivery. Values of $p<0.05$ were considered significant.
Results: There were no significant differences in baseline variables between groups. The proportion of preterm births (before 37 weeks) was 13.3% versus 23.3% (p=0.17), and before 34 weeks was 5.0% versus 10.0% (p=0.29) in the vaginal and oral groups, respectively. Mean gestational age at delivery was 37.2 ± 1.8 versus 36.5 ± 2.2 weeks (p=0.06). NICU admission occurred in 8.3% versus 15.0% (p=0.26), and adverse effects in 11.7% versus 16.7% (p=0.43).
Conclusion: There was a trend for vaginal progesterone to be superior to oral progesterone, but this was not statistically significant. More large-scale, multi-center studies are required.

Keywords: Vaginal Progesterone, Oral Progesterone, Preterm Birth, Short Cervix, Cervical Length, Randomized Controlled Trial.

INTRODUCTION

Preterm birth is a significant obstetric complication and a significant contributor to neonatal morbidity, mortality, and long-term developmental morbidity. Spontaneous preterm birth is a complex process with multiple factors including cervical remodeling, uterine activity, inflammation, membrane changes, and hormonal pathways. Early identification of women at higher risk offers a chance for preventive treatment. Transvaginal cervical-length measurement in the mid-trimester is helpful to identify asymptomatic cervical shortening. Vaginal progesterone has been identified as a key preventive measure, and there is evidence that it works in singleton pregnancies with a short cervix identified in the second and early third trimester (1). There has also been some study of women with threatened preterm labor and a short cervix diagnosed beyond the traditional mid-trimester period (24–36 weeks) (2).

The PREGNANT trial and the subsequent evidence confirmed that vaginal progesterone is an important intervention for women with a sonographically short cervix, especially when

administered before the onset of overt preterm labor (3). It has a biological basis related to inflammatory pathways, myometrial activity, and cervical remodeling. Economics also plays a role since screening consumes healthcare resources, while successful prevention can decrease neonatal morbidity and costs. The cost-effectiveness study from Sweden, which evaluated screening plus potentially beneficial preventive care (progesterone treatment) as a prevention strategy, included cervical-length screening (4). More recently, the use of progesterone in combination with other treatments for women who have cervical shortening has been studied. Evaluation of progesterone and cerclage together is an indicator of interest in possible complementary effects in selected patients (5). The broad reviews highlight the need to use a personalized approach to cervical findings, obstetric history, gestational age, and associated risk factors to prevent spontaneous preterm birth, and not to rely on a single pathway of treatment. Current evidence also shows ongoing advances in prevention and the need for the integration of available prevention interventions with a relevant risk assessment (6). A randomized trial of vaginal progesterone after arrested preterm labor showed that progesterone prolonged the pregnancy, but the women in that trial were symptomatic women with arrested preterm labor, who would not necessarily be the same as asymptomatic low-risk women who were detected by cervical screening (7). This is significant in the interpretation of evidence for the present population. Because of the uncertainty about the relative effectiveness of the available treatments, network meta-analytic research has been suggested to clarify the effects of these interventions in pregnant women with cervical shortening (8).

Another option is oral progesterone preparations, which might be more convenient for some women and can affect acceptability and adherence. Systematic evidence of the effectiveness of oral dydrogesterone in preventing preterm birth has been assessed, and it has been shown to be effective when compared with placebo (9). Vaginal progesterone is clinically relevant because of differences in pharmacokinetics, biological activity, and route-specific exposure. Vaginal progesterone was compared to nifedipine in a randomized trial in threatened preterm labor, which also highlights the investigation of progesterone-based treatment, but with different mechanisms and indications (10). Progesterone is not the only treatment option for cervical shortening. Depending on the gestation, cervical findings, obstetric history, and clinical situation, cervical cerclage, pessary, and other preventative measures may be considered.

As illustrated by the evidence on cerclage for short cervix, it is crucial to define the population and timing to assess the benefits of preventive treatment. Universal transvaginal cervical-length screening has also been linked to lower preterm birth rates, which may mean that regular screening can help to identify women in need of timely intervention for cervical prevention (12). There are differences in screening and treatment practices across countries, including whether routine measurement of the cervix length is performed, and what interventions are undertaken if the cervix is shortened (13). This variability highlights the importance of evidence to guide clinical decision-making and appropriate treatment thresholds. Randomized trials and systematic evaluations of cerclage for short cervix at 24-26 weeks also underscore the significance of gestational age and patient selection for procedural prevention (14).

The results of this study will help inform the selection of interventions, based on the clinical context. Comparative effectiveness of progesterone routes is clinically relevant as efficacy, tolerability, adherence, pharmacological exposure, and patient preference can differ between vaginal and oral administration. The comparison of evidence between the use of progesterone, cerclage, pessary, and acetylsalicylic acid has helped to understand the options available for prevention (15). Maternal biomarker screening with targeted interventions has also been assessed in a multicenter randomized trial, which adds to evidence of identifying women at risk and directing preventive care (16). Not all women are at the same risk for cervical shortening. In singleton pregnancies, the combination of cervical and clinical factors in a predictive model can estimate the risk of spontaneous preterm birth, as illustrated in the following example (17).

Progesterone is a key preventive factor to keep in mind for low-risk women with a short cervix at 20-24 weeks. This window is clinically significant because cervical shortening could be identified prior to the onset of symptoms, which could be treated at a potentially

modifiable stage in pregnancy. Direct comparison of vaginal and oral progesterone may help determine if the route of administration is related to differences in preterm birth prevention, and may provide context for effectiveness, feasibility, adherence, and tolerability, and may help clarify route choice in the context of current individualized prevention strategies for women without prior spontaneous preterm birth care.

Objective: To determine whether vaginal progesterone is more effective than oral progesterone in the prevention of preterm birth in low-risk singleton pregnancies with a sonographically short cervix (20-24 weeks).

MATERIALS AND METHODS

Study Design: A randomized controlled comparative study was designed to assess the effectiveness of vaginal vs oral progesterone in preventing preterm birth.

Study Setting: The study was carried out in the the Department of Obstetrics and Gynaecology, Peshawar Medical College.

Study Duration: Six months, from February 2026 to July 2026.

Sample Size: There were 120 pregnant women who were included and split into two groups of 60 women each, with 60 taking oral progesterone and 60 taking vaginal progesterone.

Sample Technique: The participants were recruited using consecutive sampling and then allocated randomly to the two treatment groups.

Inclusion Criteria: Women with singleton pregnancies, maternal age 18-40 years, gestational age 20-24 weeks, transvaginally measured cervical length ≤25 mm, no history of spontaneous preterm birth, and low-risk pregnancy status were included. The participants were eligible if they gave informed consent and agreed to follow up until delivery.

Exclusion Criteria: Women were excluded from the study if they had multiple pregnancy, a previous history of spontaneous preterm delivery, a major fetal anomaly, placenta previa, significant antepartum bleeding, premature rupture of membranes, active labor, cervical dilation requiring emergency intervention, medically indicated preterm delivery, progesterone contraindication, or significant maternal medical complications.

METHODS

Demographic and obstetric data were collected after enrolment on a structured proforma. Transvaginal ultrasonographic evaluation of the cervical length was conducted at 20–24 weeks of gestation and was performed with the bladder empty and in a standardized manner. Women whose cervical length was ≤25 mm were randomly divided into two equal groups.Women who had a cervical length of ≤25 mm were randomly assigned to two groups. The vaginal progesterone group was given micronized progesterone 200 mg vaginally daily, and the oral progesterone group was given oral micronized progesterone 200 mg daily. Therapy was administered until 36 completed weeks of gestation or until the baby was born. The participants were monitored at regular antenatal visits for compliance, adverse effects, cervical changes, and signs of preterm labor. Maternal outcomes were: gestational age at delivery, spontaneous preterm delivery before 37 weeks, and mode of delivery. Neonatal outcomes measured were birth weight, Apgar scores, admission to the neonatal intensive care unit, and neonatal complications. The data were analysed statistically using the appropriate test, with $P<0.05$ being statistically significant.

RESULTS

A total of 120 women with singleton pregnancies and a sonographically short cervix were analysed, with 60 women in each treatment arm. There were no significant differences between groups with regard to baseline characteristics. Mean maternal age was 28.4 ± 4.1 years in the vaginal group and 28.7 ± 4.3 years in the oral group (p=0.71), and mean cervical length at enrollment was 21.8 ± 2.4 mm and 21.6 ± 2.6 mm, respectively (p=0.66). The mean gestational age at delivery was 37.2 ± 1.8 weeks with vaginal progesterone and 36.5 ± 2.2 weeks with oral progesterone (p=0.06). Term delivery occurred in 52 women (86.7%) and 46 women (76.7%), respectively (p=0.17), while cesarean delivery was performed in 21 (35.0%) and 23 (38.3%) women (p=0.71). Treatment adherence was 91.7% and 88.3% (p=0.56). No baseline differences were found that would indicate comparability of treatment groups. These findings are presented in Table 1

Table 1: Baseline Characteristics and Maternal Outcomes by Progesterone Route

Outcome	Vaginal progesterone	Oral progesterone	p-

	(n=60)	(n=60)	value
Maternal age, years	28.4 ± 4.1	28.7 ± 4.3	0.71
Cervical length, mm	21.8 ± 2.4	21.6 ± 2.6	0.66
Preterm birth <37 weeks	8 (13.3%)	14 (23.3%)	0.17
Preterm birth <34 weeks	3 (5.0%)	6 (10.0%)	0.29
Preterm birth <32 weeks	1 (1.7%)	3 (5.0%)	0.31
Gestational age at delivery, weeks	37.2 ± 1.8	36.5 ± 2.2	0.06
Term delivery ≥37 weeks	52 (86.7%)	46 (76.7%)	0.17
Cesarean delivery	21 (35.0%)	23 (38.3%)	0.71
Treatment adherence	55 (91.7%)	53 (88.3%)	0.56
Maternal adverse effects	7 (11.7%)	10 (16.7%)	0.43

Note. Values are mean ± standard deviation or n (%). p<0.05 was considered statistically significant.

Spontaneous preterm birth before 37 completed weeks was seen in 8 women (13.3%) who were given vaginal progesterone, and 14 women (23.3%) who were given oral progesterone. The difference was in favor of the vaginal route, but not statistically significant (p=0.17). This numerical trend was also noticed at lower thresholds. Delivery before 34 weeks occurred in 3 women (5.0%) versus 6 women (10.0%) (p=0.29), and before 32 weeks in 1 woman (1.7%) versus 3 women (5.0%) (p=0.31). At each threshold studied, there was a numerically lower incidence of preterm delivery with vaginal progesterone. Figure 1 shows the distribution of preterm birth by gestational thresholds.

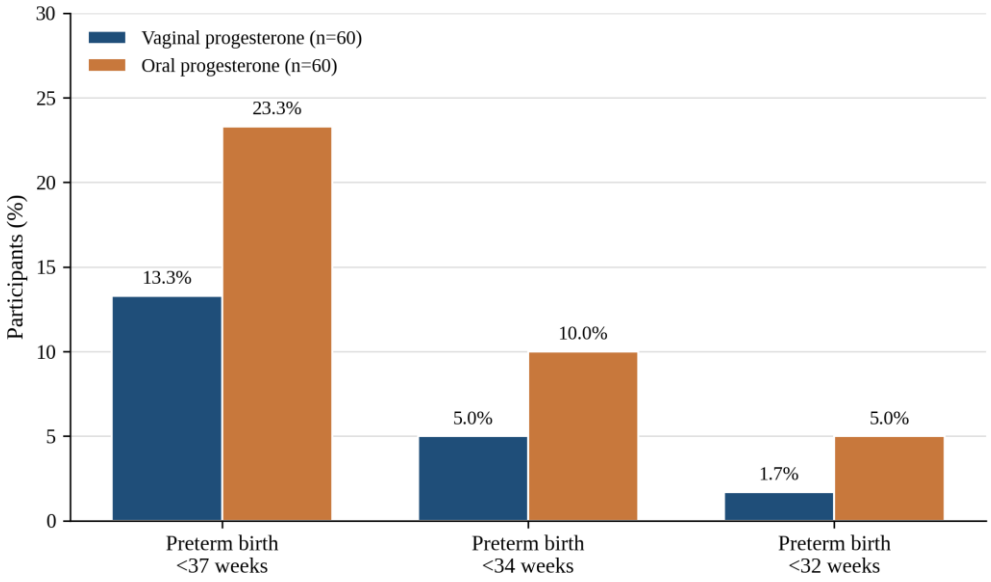


Figure 1. Rates of preterm birth by gestational age threshold in the vaginal and oral progesterone groups.

Both groups had good neonatal results. Infants of women who were treated with vaginal progesterone had a mean birth weight of 2.91 kg ± 0.46 kg, while those who were treated with oral progesterone had a mean birth weight of 2.76 kg ± 0.51 kg (p=0.09). Mean 5-minute Apgar scores were 8.7 ± 0.6 and 8.5 ± 0.7, respectively (p=0.10), and vaginal delivery occurred in 39 women (65.0%) and 37 women (61.7%) (p=0.71). Of the 5 neonates who were admitted to a neonatal intensive care unit (NICU) in the vaginal group, 9 neonates were admitted to a NICU in the oral group (p=0.26). The neonatal outcomes are summarized in Table 2.

Table 2: Neonatal Outcomes by Progesterone Route

Outcome	Vaginal progesterone (n=60)	Oral progesterone (n=60)	p-value

Birth weight, kg	2.91 ± 0.46	2.76 ± 0.51	0.09
5-minute Apgar score	8.7 ± 0.6	8.5 ± 0.7	0.10
NICU admission	5 (8.3%)	9 (15.0%)	0.26
Vaginal delivery	39 (65.0%)	37 (61.7%)	0.71

Note. Values are mean ± standard deviation or n (%). p<0.05 was considered statistically significant.

Adverse effects related to the treatment were reported by 7 of the 60 women (11.7%) in the vaginal group and 10 of the 60 women (16.7%) in the oral group (p=0.43). With vaginal treatment, the primary complaint was local discomfort or vaginal discharge, and nausea, dizziness, and fatigue occurred more often with oral treatment. Prematurity, low birth weight, and transient respiratory difficulties were the most common causes of NICU admission. There were no serious adverse events in the mother. In general, the numerical results of vaginal progesterone were favorable, but none of the differences between the groups were statistically significant. The primary delivery, neonatal, and tolerability outcomes are compared between the two groups in Figure 2.

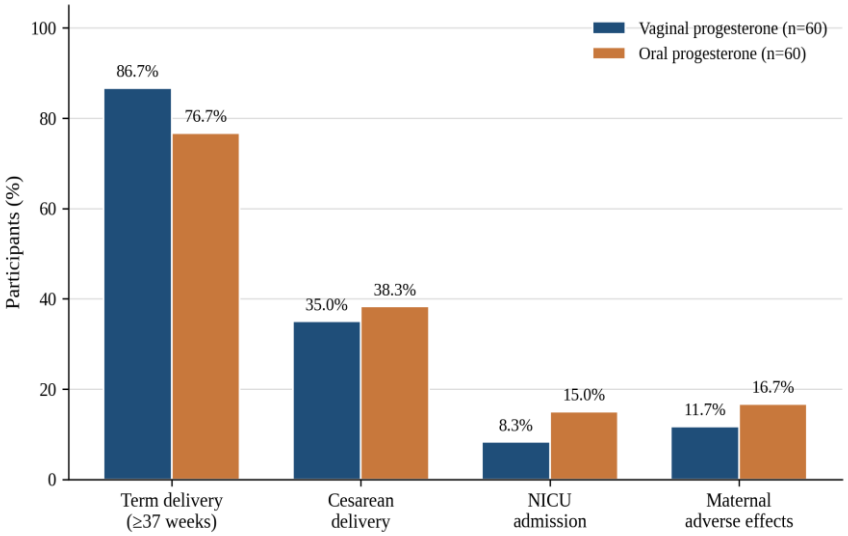


Figure 2. Comparison of term delivery, cesarean delivery, NICU admission, and maternal adverse effects between groups.

DISCUSSION

In a randomized comparison of micronized vaginal progesterone versus micronized oral progesterone in low-risk women with a short cervix at 20 to 24 weeks, the vaginal route had a lower rate of preterm birth, albeit not a statistically significant difference. The rate of spontaneous preterm birth (before 37 weeks) was 13.3% for the vaginal group and 23.3% for the oral group (p=0.17). This is in line with the evidence for vaginal progesterone in singleton pregnancies with a short cervix (1). Benefit has also been reported in women who are at risk of labor and have a short cervix diagnosed at 24 weeks gestation (2). These findings are clinically relevant as the causes of neonatal morbidity and mortality are largely related to preterm birth, and if an effective preventative pathway can be found, outcomes can be improved. The benefit was stable at lower thresholds, at 5.0% compared to 10.0% for delivery before 34 weeks and 1.7% compared to 5.0% for delivery before 32 weeks. The mean gestational age at delivery was also greater for those receiving vaginal progesterone (37.2 weeks vs. 36.5 weeks, p=0.06). These trends are in keeping with the evidence base that followed the PREGNANT trial (3). Results were also favorable in the neonatal period, with less admission to the NICU with vaginal progesterone (8.3% versus 15.0%), a finding with economic implications because if screening is successful, it can offset the cost of NICU admission (4).

The results were not statistically significant and should be interpreted with caution. The study was likely underpowered to detect such a difference, and the ten per cent difference found in an outcome with modest incidence may be due to a real, although imprecise, effect. A larger sample would help to make the interval narrower and help determine if the

trend is a real treatment effect. Some of the combined treatments (progesterone and cerclage) are also being studied for possible synergism (5), and prevention is increasingly based on a more individual approach than a single treatment pathway (6). The population studied is also a factor to be taken into account in interpretation. Vaginal progesterone has been shown to prolong pregnancy in women with arrested preterm labor, but these women were symptomatic and are not the same as the asymptomatic women found through cervical screening in the current study (7). These differences preclude direct comparison here. There is still uncertainty about the relative efficacy of the available treatments, and network meta-analytic studies are underway to resolve the relative effects of the interventions for women with cervical shortening (8).

Oral progesterone was less successful here, but should not be ruled out. There is biological plausibility as oral dydrogesterone has been compared to placebo for reducing preterm birth (9). Route-specific exposure is relevant, since the drug is administered locally to the uterus and cervix when given via the vagina, as opposed to the first-pass metabolism when given orally. In threatened preterm labor, comparisons of vaginal progesterone to other drugs, including nifedipine, also demonstrate its role as a reference drug (10). However, oral therapy may be appropriate for women who prefer not to insert it into the vagina, if it is proven to be effective. Adherence data indicate that either route was feasible in this context. There are other ways to shorten the cervix, besides using progesterone. In twin pregnancies with short cervical length, cerclage has been assessed, and this highlights the importance of population and patient selection for the benefit of procedural prevention (11). The present results are only applicable in low-risk singleton pregnancy (cervical length ≤ 25 mm). These results also have implications for screening programs, as universal transvaginal cervical length screening has been shown to decrease preterm birth rates (12).

Once shortening is detected, it is important that an effective, tolerable, and accessible treatment is available. The screening and treatment practices vary significantly across countries (13), and locally generated trial data can help inform uniform clinical decision-making and treatment thresholds. Gestational age is also significant because individual patient-level data have been used to examine cerclage for short cervix at 24-26 weeks (14). A simple daily progesterone regimen can be widely used in resource-limited tertiary settings. Both arms had acceptable tolerability and adherence as well. Adverse effects were reported by 11.7% of the vaginal users and 16.7% of the oral users, and adherence was >88% for both groups, with no serious maternal events reported. The reassuring aspect of this is that there were few adverse effects with the vaginal route, with mild local discomfort and few discontinuations.

The effect of pooled progesterone, cerclage, pessary, and aspirin analyses is population and intervention (15). This is the result that is emphasized in trials that have evaluated the effect of preventive interventions on the newborn, and birth weight was also higher here (2.91 kg vs. 2.76 kg) (16). Prediction models based on cervical and clinical characteristics may be useful to identify women most likely to benefit from cervical shortening (17). There are a few drawbacks to be noted. The study was performed at a single tertiary centre for six months; the sample was small, and follow-up only included delivery outcomes. Long-term follow-up of infants after the neonatal period would also help to elucidate long-term developmental outcomes. There is a need for larger multicenter trials. To summarize, the numerical results with vaginal progesterone were consistently better than those with oral progesterone, although there was no statistical superiority.

CONCLUSION

Overall, there were consistently better numerical trends for vaginal progesterone compared to oral progesterone in this randomized comparison of low-risk singleton pregnancies with a short cervix at 20-24 weeks. The rate of preterm delivery (<37 weeks) was lower in women receiving vaginal progesterone (13.3% compared to 23.3% in women having cesarean delivery), as was the rate of delivery before 34 and 32 weeks, and the mean gestational age at delivery was greater with vaginal progesterone. Neonatal outcomes were similar, with higher birth weight and fewer NICU admissions. In both groups, adverse effects were rarely observed and were mild, with high adherence. However, none of the differences in the primary outcome were statistically significant, and superiority of one route cannot be confidently claimed. Vaginal progesterone is a good and

tolerable alternative, and oral progesterone can be a good alternative for selected women. These findings provide evidence for personalised route selection, for tolerability, patient choice and availability. These results need to be confirmed by larger multicenter trials.

REFERENCES

1. Wang X, Maerdan M, Xi J, Zhang M, Yang H, Shi C. The effectiveness of vaginal progesterone to prevent preterm birth in singleton pregnant women with a short cervix at 18–32 weeks gestation. The Journal of Maternal-Fetal & Neonatal Medicine. 2024 Jan 2;37(1):2412751.
2. Kabiri D, Raif Nesher D, Luxenbourg D, Rottenstreich A, Rosenbloom JI, Ezra Y, Yagel S, Porat S, Romero R. The role of vaginal progesterone for preterm birth prevention in women with threatened labor and shortened cervix diagnosed after 24 weeks of pregnancy. International Journal of Gynecology & Obstetrics. 2023 May;161(2):423-31.
3. Romero R, Meyyazhagan A, Hassan SS, Creasy GW, Conde-Agudelo A. Vaginal progesterone to prevent spontaneous preterm birth in women with a sonographic short cervix: the story of the PREGNANT trial. Clinical Obstetrics and Gynecology. 2024 Apr 5;67(2):433.
4. Wikström T, Kuusela P, Jacobsson B, Hagberg H, Lindgren P, Svensson M, Wennerholm UB, Valentin L. Cost-effectiveness of cervical length screening and progesterone treatment to prevent spontaneous preterm delivery in Sweden. Ultrasound in Obstetrics & Gynecology. 2022 Jun;59(6):778-92.
5. Berghella V, Paladino I, Gulersen M, Sayres LC, Roman A, Boelig R. Progesterone and cerclage together for short cervix: evaluating potential complementary effects for improved preterm birth prevention. American Journal of Obstetrics & Gynecology MFM. 2026 Jul 10:102055.
6. Ahmed B, Abushama M, Konje JC. Prevention of spontaneous preterm delivery–an update on where we are today. The Journal of Maternal-Fetal & Neonatal Medicine. 2023 Dec 31;36(1):2183756.
7. Nachum Z, Ganor Paz Y, Massalha M, Wated M, Harel N, Yefet E. Vaginal progesterone for pregnancy prolongation after arrested preterm labor: a randomized clinical trial. JAMA network open. 2024 Jul 8;7(7):e2419894.
8. Luo J, Liu D, Liu J. Different interventions to prevent preterm birth in pregnant women with cervical shortening during pregnancy: a protocol for a network meta-analysis. BMJ open. 2024 Nov;14(11):e084015.
9. Hedawy S, Aldalahmeh S, Labeeb EE, Khattab AA, Khalid E, Hassan A, Menshawy A. Effectiveness of oral dydrogesterone compared to placebo in reducing the risk of preterm birth: a systematic review and meta-analysis. BMC Pregnancy and Childbirth. 2026 Feb 24;26(1):222.
10. Mohamed MO, Wafa Y. Comparison of the Efficacy of vaginal Progesterone and Nifidipine in inhibiting Threatened preterm labour: A randomized controlled study. Al-Azhar International Medical Journal. 2022 Jun 1;2022(6):104-9.
11. D'Antonio F, Eltaweel N, Prasad S, Flacco ME, Manzoli L, Khalil A. Cervical cerclage for prevention of preterm birth and adverse perinatal outcome in twin pregnancies with short cervical length or cervical dilatation: a systematic review and meta-analysis. PLoS medicine. 2023 Aug 3;20(8):e1004266.
12. Figarella A, Chau C, Loundou A, d'Ercole C, Bretelle F. The introduction of a universal transvaginal cervical length screening program is associated with a reduced preterm birth rate. American Journal of Obstetrics and Gynecology. 2023 Feb 1;228(2):219-e1.
13. van Limburg Stirum EV, Pilarski N, de Boer MA, Pajkrt E, Oudijk MA, van't Hooft J. Variation between countries for routine transvaginal cervical length measurement and interventions to prevent preterm birth. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2024 Dec 1;303:266-71.
14. Lenchner PE, Nicolaides MK, Otsuki MK, Rust MO, Althuisius MS, Bornstein ME, Berghella MV. Cervical cerclage for short cervix at 24 to 26 weeks of gestation: systematic review and meta-analysis of randomized controlled trials using individual patient-level data. American journal of obstetrics & gynecology MFM. 2023 Jun 1;5(6):100930.
15. Wennerholm UB, Bergman L, Kuusela P, Ljungström E, Möller AC, Hongslo Vala C, Ekelund AC, Liljegren A, Petzold M,

Sjögren P, Svensson M. Progesterone, cerclage, pessary, or acetylsalicylic acid for prevention of preterm birth in singleton and multifetal pregnancies–a systematic review and meta-analyses. Frontiers in medicine. 2023 Feb 28;10:1111315.

16. Iriye BK, O'Brien JM, Ennen CS, Barrilleaux PS, Berkin JA, Palatnik A, Son M, Gyamfi-Bannerman C, McDonnold M, Markenson GR, Sciscione AC. Neonatal impact of maternal biomarker screening for risk of preterm birth with targeted interventions (PRIME): A multicenter, randomized, controlled trial. Pregnancy. 2026 Jan;2(1):e70202.
17. Sun Y, Lian F, Deng Y, Liao S, Wang Y. Development and validation of a nomogram to predict spontaneous preterm birth in singleton gestation with short cervix and no history of spontaneous preterm birth. Heliyon. 2023 Oct 1;9(10).