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Effectiveness of cervical cerclage in preventing preterm birth

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Abstract
Background: The delivery of newborn babies before term is one of the main causes of the high rates of death and illness in newborn babies, particularly those of women who have had a spontaneous preterm delivery or those with cervical insufficiency. The use of cervical cerclage as a surgical procedure for the prevention of preterm birth in high-risk pregnancies is well described, but the extent of its benefit in improving pregnancy outcomes is a topic of much research.
Objective: This study aimed to assess the effectiveness of cervical cerclage on prevention of preterm birth, maternal, fetal and neonatal outcomes such as gestational age at delivery, birth weight, and neonatal morbidity in the high-risk pregnant women.
Methodology: A prospective interventional controlled trial was conducted at Tikrit Teaching Hospital from March 2024 to March 2025. In total, 300 pregnant women with high risk of preterm delivery were included in the study. Patients were divided into two groups: the intervention group received cervical cerclage (n = 150) and the control group (n = 150). The primary outcome of interest was gestational age at birth, with secondary outcomes being preterm birth, birth weight, NICU admission, and neonatal death. Data were collected using SPSS, with statistical methods including Chi-square, independent t-tests, and multivariate logistic regression.
Results: The mean gestational age at delivery in the cerclage group was significantly higher (37.9 ± 1.8 weeks) than in the control group (34.2 ± 2.6 weeks, $p< 0.001$). The preterm birth rate in the cerclage group was 17.3%, which was significantly lower compared to the control group (46.0%, $p< 0.001$). The birth weight in the cerclage group was significantly higher (2850 ± 420 grams vs. 2360 ± 510 grams, $p< 0.001$), and neonatal mortality was lower (1.3% vs. 5.3%, p = 0.048). The most common procedure-related complication was mild vaginal bleeding (4.0%).
Conclusion: Cervical cerclage improves pregnancy outcomes in high risk women, the increase in gestational age at delivery, decrease in preterm birth, increase in birth weight and decrease in neonatal mortality. Despite the low rate of complications, cervical cerclage can be considered as an effective measure for the management of high-risk pregnancies and preterm birth prevention.

Keywords: Cervical cerclage, preterm birth, pregnancy outcomes, neonatal mortality, obstetrics

Introduction

Preterm birth which occurs before 37 weeks of gestation stands as a major reason for neonatal illness and death throughout the world. According to the World Health Organization (WHO), preterm birth affects approximately 1 in 10 births globally, contributing to significant health challenges for both the infant and the mother (Howson *et al*., 2012) [12]. The premature birth of infants is associated with a wide range of complications, including respiratory distress syndrome, developmental delays, and increased risk of infections, all of which can have long-term health consequences. The healthcare systems face substantial financial strain because preterm birth requires extensive hospital care and intensive medical treatment for newborns (Quinn *et al*., 2016) [15].

Cervical insufficiency emerges as a specific identifiable risk factor for preterm birth alongside other contributing factors. The condition of cervical insufficiency or incompetent cervix triggers early cervical opening during pregnancy which leads to spontaneous preterm labor and delivery (Lin and Li 2024) [14]. Women who have had cervical insufficiency or spontaneous preterm birth are at greater risk of preterm delivery in their following pregnancies. Premature cervical dilation shows increased risk during clinical conditions that include multiple gestations or uterine anomalies or infections. According to Zhu *et al*. (2023) [18] the prevention of preterm birth in high-risk women remains a top priority for obstetricians

and healthcare providers. Cervical cerclage serves as one of the interventions that healthcare providers use for women who have cervical insufficiency and face high risks of preterm birth. A suture gets placed around the cervix to provide mechanical support that blocks premature cervical dilation (Brown *et al*., 2019) [6]. The medical staff perform this procedure during the second trimester at 12 to 24 weeks of gestation. Cervical cerclage functions to improve the strength of the cervix and block early cervix dilation while allowing the pregnancy to reach full term (Yakoob, *et al*., 2019) [17]. The medical staff typically recommend this procedure to pregnant women who have experienced spontaneous preterm birth or show signs of a short cervix through ultrasound exams or other cervical insufficiency indicators (Biggio, 2021) [5].

Cervical cerclage procedures are commonly used yet their effectiveness remains disputed among medical professionals. Research studies have established that the procedure offers benefits for women who have short cervixes or who have experienced previous preterm births. Research studies have shown that cervical cerclage reduces preterm birth rates and extends gestational age while resulting in better NICU admission and birth weight outcomes (Al Hussaini, *et al*., 2024) [3]. The research does not support these findings entirely since some studies show the procedure does not benefit all women particularly those without cervical insufficiency or preterm birth history. The extensive use of cervical cerclage remains limited due to potential complications which include infections vaginal bleeding and preterm membrane ruptures (Xu *et al*., 2023) [16]. The main goal of this research is to evaluate how cervical cerclage works in preventing premature births while improving pregnancy results for women with preterm labour risks with a focus on delivery age and preterm delivery rates and infant birth weight and NICU admission statistics.

Methodology

Study Design

The research adopted a prospective interventional controlled trial design at Tikrit Teaching Hospital from March 2024 through March 2025. The research included 300 pregnant women who attended during their third month of pregnancy and fulfilled the predefined inclusion criteria.

Data collection

The selection criteria focused on women who faced preterm birth risks because they experienced previous spontaneous preterm deliveries or showed signs of cervical insufficiency through transvaginal ultrasound. The participants received random assignment into two groups which included the intervention group that received cervical cerclage and the control group that did not receive the procedure.

Materials

The research employed ultrasound devices to measure cervical length and standard surgical tools to execute cervical cerclage procedures. The study evaluated cervical length and gestational age at delivery and preterm labor and neonatal outcomes including birth weight and NICU admission. The research team conducted scheduled antenatal visits throughout pregnancy to track maternal and fetal development.

Statistical Analysis

The data analysis was performed using SPSS software version 22.0. The study applied descriptive statistics to display participant demographic characteristics together with clinical measurements. The Chi-square test assessed categorical variables such as preterm birth incidence between groups while independent t-tests evaluated continuous variables including gestational age at delivery and birth weight. The study performed logistic regression analysis to determine preterm birth risk associated with cervical cerclage while controlling for confounding variables. The research established statistical significance through p-values below 0.05.

Ethical Considerations

The Institutional Review Board (IRB) of the College of Medicine at Tikrit University provided ethical approval for this study. The study participants received detailed information about the research objectives and methods as well as the associated dangers and advantages. The researchers acquired written consent from each participant through an informed consent process before starting the study. The study protected all patient information from disclosure while ensuring participants could withdraw from the study at any time without impact on their medical care.

Results

Demographic and Baseline Characteristics

The baseline demographic and obstetric characteristics presented in table 1 showed no differences between the two groups. The two groups showed no statistically significant differences in maternal age, gravidity, history of preterm birth or baseline cervical length. The two groups were identical at the beginning of the study.

Table 1: Baseline Characteristics of Participants

Variable	Cerclage Group (n = 150)	Control Group (n = 150)	*p*-value
Mean maternal age (years)	28.1 ± 5.2	27.5 ± 5.6	0.314
Gravidity (median, range)	3 (1-6)	3 (1-7)	0.642
History of preterm birth (%)	97 (64.7%)	91 (60.7%)	0.469
Cervical length at baseline (mm)	22.8 ± 2.5	22.6 ± 2.7	0.537

Pregnancy Outcomes

The cerclage group demonstrated significantly improved outcomes. The cerclage group achieved higher mean gestational age at delivery ($p< 0.001$). The preterm birth rate in the cerclage group (17.3%) was substantially lower than the control group (46.0%) with a highly significant difference ($p< 0.001$) (Figure 1). The birth weights in the cerclage group were higher than in the other group and NICU admissions were lower. The neonatal mortality rate was lower in the cerclage group ($p = 0.048$) which suggests that the intervention had a protective effect (Table 2).

Table 2: Primary and Secondary Pregnancy Outcomes

Outcome Variable	Cerclage Group (n = 150)	Control Group (n = 150)	*p*-value
Gestational age at delivery (weeks)	37.9 ± 1.8	34.2 ± 2.6	< 0.001
Preterm birth (< 37 weeks), n (%)	26 (17.3%)	69 (46.0%)	< 0.001
Mean birth weight (grams)	2850 ± 420	2360 ± 510	< 0.001
NICU admission, n (%)	18 (12.0%)	42 (28.0%)	0.002
Neonatal death, n (%)	2 (1.3%)	8 (5.3%)	0.048

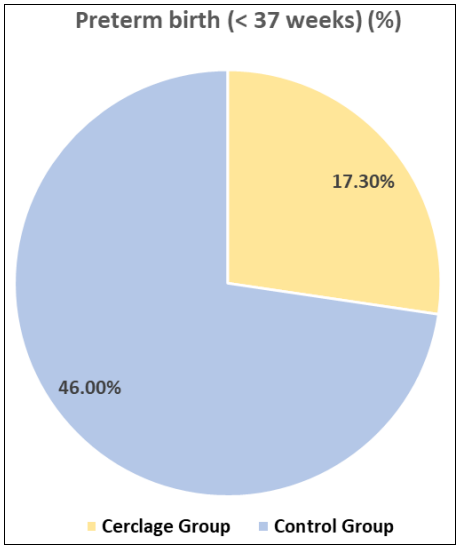

Fig 1: Preterm birth in the Studied Groups

Procedure-Related Complications in the Cerclage Group

The data presented in table 2 showed that procedure-related complications were few and easily controlled. The most frequent complication was mild vaginal bleeding (4.0%), followed by premature rupture of membranes (3.3%). Infection occurred in 2.0% of cases. The premature removal of cerclages because of complications occurred in 1.3% of cases (Figure 2).

Table 3: Cerclage-Related Complications

Complication	Number (n = 150)	Percentage (%)
Vaginal bleeding	6	4.0%
Infection (chorioamnionitis)	3	2.0%
Premature rupture of membranes	5	3.3%
Cerclage removal due to symptoms	2	1.3%

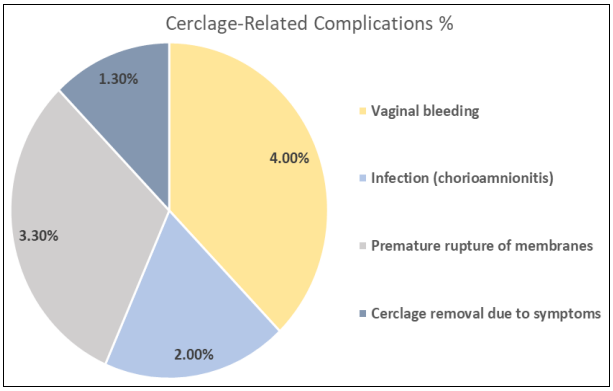

Fig 2: Cerclage-Related Complications Percentage (%)

Multivariate Logistic Regression Analysis for Risk of Preterm Birth

The results of multivariate analysis showed that cervical cerclage decreased the risk of preterm birth (OR = 0.28, $p < 0.001$) after controlling for other risk factors. Previous preterm birth and short cervical length were the only significant risk factors for preterm birth. Maternal age over 35 was not a significant predictor in this sample (Table 4).

Table 4: Logistic Regression Analysis

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	*p*-value
Cerclage performed	0.28	0.17 - 0.47	< 0.001
Previous preterm birth	2.12	1.28 - 3.52	0.004
Short cervical length (< 20 mm)	1.85	1.10 - 3.12	0.019
Maternal age > 35 years	1.03	0.55 - 1.94	0.932

Discussion

The baseline characteristics including maternal age gravidity preterm birth history and cervical length measurements showed no significant differences between the two groups. The study results match Abbott *et al.* (2012) which showed that cervical length at baseline serves as a preterm birth predictor yet needs evaluation with other factors including preterm birth history and maternal inflammatory responses. The identical baseline characteristics between groups establishes a valid comparison between the cerclage group and control group so researchers can analyze intervention effects independently of initial differences.

The gestational age at delivery served as the primary outcome variable which showed a substantial improvement in the cerclage group at 37.9 ± 1.8 weeks compared to the control group at 34.2 ± 2.6 weeks with a highly significant p-value (< 0.001). The findings from Chandiramani *et al.* (2011) and Chandiramani *et al.* (2012) support the use of cervical cerclage to extend pregnancy duration among women who have a short cervix or previous preterm deliveries.

The cerclage group showed a lower preterm birth rate of 17.3% compared to the control group at 46.0% which demonstrates the effectiveness of the intervention. The research results match the findings of Alfirevic *et al.* (2017) [4] and Abdel-Aleem *et al.* (2022) [2] who established that cerclage effectively lowers spontaneous preterm birth rates among women with cervical insufficiency or previous preterm labor experiences.

The cerclage group achieved a significantly higher birth weight average of 2850 ± 420 grams than the control group at 2360 ± 510 grams which demonstrates the beneficial effects of the intervention on fetal growth. The study by Hulshoff *et al.* (2023) [13] confirmed that cerclage prevents preterm birth which results in better neonatal outcomes through increased birth weights and decreased NICU admissions.

The study results show that neonatal death rates were lower in the cerclage group at 1.3% than in the control group at 5.3% which matches previous research findings (Frenken *et al.*, 2022) [11]. The protective effect of cerclage on neonatal mortality demonstrates why preterm birth risks need to be addressed in high-risk pregnancies because preterm birth acts as a major risk factor for neonatal morbidity and mortality.

The cerclage group had few procedure-related complications with vaginal bleeding being the most common at 4.0%. Frenken *et al*. (2022) [11] support this finding by showing that cervical cerclage has a low risk of complications although it exists. The study recorded two complications: infection (2.0%) and premature rupture of membranes (3.3%) but these issues remained under control without causing major effects on maternal and neonatal results. The study by Alfirevic *et al*. (2017) [4] showed that although complications can occur, they remain rare and doctors can handle them effectively.

The multivariate analysis showed that cervical cerclage reduced preterm birth odds by 0.28 ($p< 0.001$) even when controlling for preterm birth history and short cervical length. The results of this study confirm the outcomes of previous research by Chandiramani *et al*. (2010) [8] and Abdel-Aleem *et al*. (2022) [2] which showed that cerclage effectively lowers preterm birth risks especially among women with short cervixes or previous preterm deliveries. The sample data showed that advanced maternal age did not prove to be a risk factor for preterm birth thus indicating other factors such as cervical length and previous preterm birth might play a more significant role in determining preterm birth risk.

Conclusion

The study results demonstrate that cervical cerclage functions as an effective treatment to stop preterm birth and improve pregnancy outcomes for women who are at high risk. The cerclage group obtained better results through their deliveries at advanced gestational ages and decreased preterm birth rates and heavier birth weights and fewer infant complications leading to death. The procedure results in minimal complications yet remains essential for managing high-risk pregnancies. The findings align with previous research and future studies should investigate how cervical cerclage affects long-term patient results together with its advantages for different patient populations.

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Conflict of Interest

Not available

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Not available

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