To Identify Risk Factors Predicting Spontaneous Preterm Labor Less Than 28 Weeks After Emergency Cerclage in the Second Trimester of Pregnancy

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Research Article

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Abstract

Purpose To identify risk factors predicting spontaneous preterm labor (sPTB) less than 28 weeks after emergency cerclage in the second trimester of pregnancy.

Methods 106 cases with Prolapsed membranes in the second trimester of pregnancy who underwent emergency cerclage were collected from July 2019-July 2021 .39 cases who happened sPTB less than 28 weeks were in case group. 67 cases were in control group.Univariate analysis and logistic regression analysis were used to identify the risk factors for sPTB less than 28 weeks after emergency cerclage.

Results Among the 106 cases,37cases developed sPTB less than 28 weeks, and the incidence was 36.8%, Univariate analysis showed that positive cervical culture,cervical dilatation,the location of amniotic membranes and histologic chorioamnionitis were related with sPTB($P<0.05$). Logistic regression analysis showed that histologic chorioamnionitis was the risk factors for sPTB after emergency cerclage in patients with Prolapsed membranes in the second trimester of pregnancy[relative risk14.603 ,95% confidence interval(CI)2.621-81.369, $P<0.05$].Amniotic membrane is an independent risk factor for less than 28 weeks of sPTB after emergency cerclage in middle pregnancy [relative risk11.993 ,95% confidence interval(CI)3.825-37.607, $P<0.05$].

Conclusion The independent risk factors of sPTB less than 28 weeks after emergency cerclage with prolapsed membranes in the second trimester of pregnancy was histologic chorioamnionitis and Amniotic membrane.

Introduction

Prolapsed membranes in the second trimester of pregnancy was an obstetric emergency disease.The patient had a painless cervical dilation, which is founded on speculum examination and transvaginal ultrasound. If the effective measures is not taken,a spontaneous abortion within a week.Surgery is a key treatment for prolonging the delivery interval. A emergency cerclage may be insered when the patient presents with a cervix that is already dilated with the membranes bulging into the vaginal. but the pregnant women at high risk of premature rupture of fetal membranes and spontaneous preterm birth after postoperative.Spontaneous preterm delivery of less than 28 weeks is the most common serious complication after emergency cervical cerclage. premature babies are at greater risk of cerebral palsy,visual and auditory disturbances[1].Preterm birth remains the major cause of mortality and morbidity before and after birth,create a huge public health burden[2].There are still no specific indicators to predict the occurrence of sPTB. Therefore, the risk factors for sPTB occurrence in patients after emergency cerclage were analyzed,It is of great significance to discuss the prevention and control measures,This paper includes 106 cases admitted to our hospital from July 2019 to July 2021 in a retrospective study,which of inserting an emergency cerclage,The occurrence and risk factors of s PTB after less than 28 weeks were analyzed.

Materials And Methods

This study was based on a single-center and prospective clinical study in patients with spontaneous premature birth after emergency cervical cerclage in Henan Province, which was reviewed and approved by the Ethics Committee of Henan Provincial People's Hospital. The 106 patients in July 2019 to July 2021 were selected in the clinic. The degree of cervical dilation were found by speculum examination and transvaginal ultrasound.

1.1. Inclusion criteria

16-26+6 weeks singleton; a painless cervical dilation with 1-6cm; bulging of the membranes into the vagina, the membranes was intact; at least one second trimester pregnancy loss, or preterm birth; no contractions, normal body temperature, and no uterine tenderness.

1.2 Exclusion criteria

a painless cervical dilation > 7cm; premature rupture of fetal membranes; active vaginal bleeding; the fetal structure was abnormal.

1.3 surgical operation

Cervical cerclage was performed using the McDonald technique: the trendelenbury position, epidural anesthesia was used. Two double ten sutures stitched into the anterior cervical lip, left wall, right wall, and posterior cervical lip. The suture should be deep when stitching the anterior cervical lip, Suture enough cervical interstima, which is in 1/3-2/3 cervical thickness, avoid sliding, but do not sew into the cervical canal. Small cervical matrix suture should be stitched on the cervical side wall. Fixed braid line in place. Avoid hurting the uterine arteries. The line tail is knotted in the front. Keep 3-4cm for subsequent removal. Cervical cerclage is usually stitched into the needle and needle point, respectively at 1-11 points, 10-8 points, 7-5 points, 4-2 points, up and down two stitches and right two stitches are basically parallel. All patients were treated by the same group of senior physicians using the standard McDonald suture technique.

If the protrusion of the fetal membranes still in the cervical canal, Self-made balloon push amniotic sac technology is used. The tip of the catheter air bag was cut off and the sterile middle finger glove of the coat was used to prevent the puncture of the tip of the catheter. The balloon was injected with 10-30ml of saline and draining a prolapsed fetal membranes return into the uterine cavity. After the suture, the saline was removed, and the catheter and sterile glove skin were removed. If the saline was 10-30mL, the sterile glove skin was intact without damaged, which confirmed that no suture penetrated the cervical stroma during surgery. If the amniotic sac expands out to the cervical cervix, use wet gauze to push the amniotic sac to the cervical cervix, tighten the suture after suture, and gently exit the wet gauze.

1.4 postoperative management of emergency cerclage

If there are no complications after cerclage, he will be in hospital 7-14 days after cerclage, Peripheral insurance is performed every 2 weeks to monitor the length of the cervical length and fetal development. For the occurrence of regular uterine contraction after cervical cerclage, premature birth or late abortion is inevitable, timely removal of cervical line, The placenta was sent for pathological examination.

1.5 Pregnancy outcomes

The primary outcomes were the rate of sPTB < 28 weeks and to identify the risk factors for sPTB < 28 weeks after emergency cerclage.

The secondary outcome were delivery interval, pregnancy at delivery, neonatal birth weight, respiratory distress syndrome of newborn, neonatal hospital stays and placental histological chorioamnionitis.

1.6 Statistical analysis

Data were processed with SPSS25.0, quantitative data meeting the normal distribution using mean standard deviation, two independent sample t-tests, median M for non-normal distribution (P25, P75) and non-parametric test Mann-whitney U test. Qualitative data are expressed as frequency and percentage, used χ^2 tests or continuous correction χ^2 tests compared between less than the 28-week sPTB and non-sPTB groups. Statistically significant variables were included in the Logistic regression analysis, $P < 0.05$ was considered as a statistically significant difference.

Results

2.1 Table 1 shows Patient demographic characteristics and general basic clinical characteristics comparing case group and control group. Despite emergency cerclage in 106 cases, 39/106 (36.8%) delivered < 28 weeks' gestation. Delivery weeks (27 (26, 28) vs 31 (29, 36), $P = 0.000$). There were significant differences between delivery interval weeks, inside cervix expansion, outside cervix expansion, residual cervical length, neonatal birth weight, neonatal hospital stays compared with control group ($P < 0.05$). There were no significant differences between age and gestational weeks compared with control group ($P > 0.05$).

2.2 Table 2 shows univariate analysis of preterm birth at less than 28 weeks. Cervical dilation at diagnosis (relative risk 10.629, 95% confidence interval (CI) 3.511-32.17, $P < 0.001$). Amniotic membrane (relative risk 11.508, 95% confidence interval (CI) 4.407-30.048, $P < 0.001$), Positive cervical culture (relative risk 4.197, 95% confidence interval (CI) 1.552-11.354, $P < 0.001$). Histological chorioamnionitis (HCA) (relative risk 12.956, 95% confidence interval (CI) 4.001-48.579, $P < 0.001$).

There were statistical significant differences in cervical dilation at diagnosis, amniotic membrane, positive cervical culture, and histological chorioamnionitis (HCA) compared with control group ($P < 0.05$). There were no statistical significant differences between gestational age (GA) at diagnosis, embryo transplantation, cervix operation, and chronic hypertension and diabetes mellitus compared with the control group ($P > 0.05$).

2.3 Table 3 shows results of a Logistic regression analysis of less than 28 weeks of preterm birth. Whether it occurred for less than 28 weeks of sPTB was used as the dependent variable. Logistic regression was performed using statistically significant factors in univariate analysis as independent variables. The results show histologic chorioamnionitis is an independent risk factor for less than 28 weeks of sPTB after emergency cerclage in middle pregnancy (relative risk 14.603, 95% confidence interval (CI) 2.621-81.369, $P < 0.05$). The results show Amniotic membrane is an independent risk factor for less than 28 weeks of sPTB after emergency cerclage in middle pregnancy (relative risk 11.993, 95% confidence interval (CI) 3.825-37.607, $P < 0.05$).

2.4 Table 4 shows neonatal outcome. There were statistical significant differences in severe neonatal asphyxia, hyperbilirubinemia, respiratory distress syndrome, premature fetal membrane rupture (PROM) compared with control group ($P < 0.05$). There were no statistical significant differences between assisted breath, and neonatal Intensive care unit (NICU) compared with the control group ($P > 0.05$).

Table 1 Basic characteristics of the patients in both patient groups

Variable	Case group (n=39)	Control group (n=67)	<i>P</i>
Age(years)	29.10±0.63	30.25±0.47	0.080
Gestational weeks(weeks)	20.99±0.57	20.07±0.47	0.859
Delivery weeks(weeks)			
M(P25-P75)	27(26,28)	31(29,36)	0.000
Delivery interval(weeks)			
M(P25-P75)	4.43(3.43,7.00)	12.57(7,15.43)	0.000
Inside cervix expansion(mm)			
M(P25-P75)	28(20,39)	18(12,21)	0.001
Outside cervix expansion(mm)			
M(P25-P75)	16(7,30)	8.5(1,15)	0.001
Residual cervical length(mm)			
M(P25-P75)	8.9(1,12)	18(10,21)	0.000
Neonatal birth weight (g)	909.36±41.22	1999.33±110.59	0.000
Neonatal hospital stays(days)			
M(25-P75)	45(28,53)	29(7,39)	0.000

Table 2 A univariate analysis with less than 28 weeks of sPTB

Variable	Case group (n=39)	Control group (n=67)	χ^2	<i>P</i>	<i>OR</i>	<u>95% CI</u> XX XX
GA at diagnosis						
≤22 weeks	20(51.3%)	32(47.8)	0.122	0.727	0.869	0.394 1.914
>22 weeks	19(48.7%)	35(52.2%)				
Cervical dilation at diagnosis						
≤4cm	21(53.8%)	62(92.5%)	21.720	0.000	10.629	3.511 32.17
>4cm	18(46.2%)	5(7.5%)				
Amniotic membrane						
within cervical canal	14(35.9%)	58(86.6%)	29.049	0.000	11.508	4.407 30.048
Beyond external os	25(64.1%)	9(13.4%)				
Cervical V-shaped expansion	21(53.8%)	18(56.7%)	4.275	0.039	0.427	0.189 0.964
embryo transplantation	24(61.5%)	46(68.7%)	0.557	0.456	1.369	0.599 3.128
Positive cervical culture	33(84.6%)	38(56.7%)	8.676	0.003	4.197	1.552 11.354
Secondary cerclage	7(17.9%)	2(3.0%)	5.309	0.021	7.109	1.396 36.194
HCA	37(94.9%)	34(50.7%)	21.702	0.000	12.956	4.001 48.579
Cervix operation	3(7.7%)	5(7.5%)	0.004	0.951	0.670	0.124 3.631
Chronic hypertension	3(7.7%)	2(3.0%)	0.394	0.530	2.708	0.432 16.967
Diabetes mellitus	10(25.6%)	15(22.4%)	0.145	0.704	1.195	0.476 3.000

Table 3 Results of the Logistic regression analysis

Variable	b	SE	Wald χ^2	P	OR[95%CI]
Positive cervical culture	0.627	0.667	0.884	0.347	1.873[0.506-6.924]
Cervical dilation at diagnosis	0.866	0.558	2.407	0.121	0.421[0.141-1.256]
Amniotic membrane	2.484	0.583	18.152	0.000	11.993[3.825-37.607]
HCA	2.681	0.876	9.359	0.002	14.603[2.621-81.369]

Table 4 Neonatal pregnancy outcomes in both groups

Variable	Case group (n=39)	Control group (n=67)	χ^2	P	OR	95%CI
Vaginal delivery	31(79.5)	33(49.3)	9.419	0.002	0.250	0.101 0.624
Severe neonatal asphyxia	15(38.5)	2(3.0)	20.481	0.000	20.313	4.230 95.501
Hyperbilirubinemia	16(41.0)	11(16.4)	7.863	0.005	3.542	1.428 8.783
Respiratory distress syndrome	31(79.5)	30(44.8)	12.157	0.000	4.779	1.915 11.924
Trachea cannula	11(28.2)	2(3.0)	12.322	0.000	12.768	2.655 61.397
Assisted breath	21(53.8)	32(47.8)	0.365	0.546	1.276	0.578 2.815
NICU	34(87.2)	48(71.6)	3.398	0.065	2.692	0.915 7.915
PROM	30(76.9)	24(35.8)	16.664	0.000	5.972	2.436 14.643

GA,gestational age;PROM,premature rupture of membranes;NICU,Neonatal Intensive Care Unit;HCA,histological chorioamnionitis; OR,odds ratio; CI, confedence interval

Discussion

3.1 Treatment effect of emergency cervical cerclage on Prolapsed membranes in the second pregnancy

Cervical insufficiency is the main cause of painless progressive cervical dilation in the second pregnancy and extremely preterm birth[3].Cervical cerclage represents a surgical intervention to prevent spontaneous

preterm birth, Emergency cervical cerclage reduces preterm birth, provides prolonged gestational weeks, and reduces neonatal mortality and loss rates. SOGC[4] recommends emergency cervical cerclage in a singleton pregnant cervix less than 4cm without contractions. The Han et al [5] retrospective study analyzed the prolonged pregnancy interval of 5-7 weeks after cervical dilation > 1cm compared to the conservative treated group. Emergency cervical cerclage is an active treatment that extends gestational weeks and increases neonatal survival, However, premature fetal membrane rupture occurs in 4%-9% postoperative cases, when the amniotic cavity intrauterine infection is present, the effect of cerclage decreases significantly[6]. Several studies have shown that the amniotic sac is located beyond external os and that the cervix dilation of 1.5cm is an independent risk factor for failure after cerclage[7], The Baryk M et al[8] study evaluated emergency cervical cerclage with less than 28 weeks of premature birth at 75/252 (29.7%), In this study, 106 patients underwent emergency cervical dilation and amniotic protrusion, and 39 had sPTB less than 28 weeks with an incidence of 36.8%, Higher than the above study may be related to a higher proportion of cervical expansion greater than 4cm (18 cases). Emergency cervical cerclage has a positive effect on pregnancy outcome with cervical dilation > 4cm, less than spontaneous prematurity of 18/37 (46.2%) at 28 weeks, prolonged gestational interval of 4.43 (3.43, 7.00) weeks. In patients with cervical dilation > 4cm and prolapsed membrane emergency cerclage is an intervention to extend the gestational week to reach the viable ability of the fetus. To avoid this emergency, predicting risk factors for spontaneous preterm birth is an important part of current prenatal clinical work[9]. We advocate midtrimester ultrasound for cervical length screening and is a predictor of the prevention of sPTB[10]. Cervical insufficiency is painless, lack of obvious clinical symptoms, no objective diagnosis, and is largely dependent on clinical experience, production history, and retrospective diagnosis of ultrasound scan. Through color ultrasound examination, the degree of cervical internal and external expansion, V-shaped, U-shaped expansion, the length of cervical closure section, to guide clinical intervention measures as soon as possible. In this study, the degree of cervical dilation is greater than 4cm, and less than 28 weeks of spontaneous prematurity (case group) of 18/39 (46.2%) is significantly higher than that in the control group of 5/67 (7.5%), The amniotic sac is beyond external os 25/39 (64.1%) higher than in control group 9/67 (13.4%). In the second trimester of pregnancy, color ultrasound is used to find the cervical opening situation and the location of the amniotic membrane, It is of great clinical significance to guide early clinical interventions to reduce spontaneous premature birth.

3.2 Analysis of risk factors for spontaneous preterm birth at less than 28 weeks after emergency cerclage.

Emergency cerclage is a rescue procedure, but there are still some premature deliveries after surgery, and the biological mechanism is not completely clear. Preterm birth in China is defined as delivery between 28 and 37 weeks, so 28 weeks gestation was chosen as the cutoff for the study factors associated with the clinical effect of cervical cerclage. Extreme preterm birth is defined as delivery at less than 28 weeks of gestation[11]. The etiology of extreme preterm birth is mainly divided into two categories: intrauterine infection / inflammation and placental vascular dysfunction, The first type of etiology is associated with chorioamnionitis, premature fetal membrane rupture, and cervical insufficiency, The second etiology is associated with hypertension during pregnancy and fetal growth restriction[12]. Alfievic et al[13] An

increased risk of chorioamnionitis in patients with cervical insufficiency is systematically reported. Chorioamnionitis (chorionamnionitis,CAM), an inflammatory response formed by placental tissue by pathogen infection, is a common complication during pregnancy, divided into clinical chorioamnionitis (clinical chorioamnionitis,CCA) and tissue chorioamnionitis (histological chorioamnionitis,HCA),HCA refers to no clinical manifestations only on postnatal pathological examination, 2-3-fold incidence of CCA[14].HCA is considered to be the major cause of extreme preterm delivery, and a substantial meta-analysis of chorioamnionitis is strongly associated with adverse pregnancy outcomes in extreme preterm birth with complications such as bronchopulmonary dysplasia[15], Premature retinopathy of the disease[16], neonatal sepsis, and respiratory distress syndrome[17].The Uzun Cilingir et al[18]study found that the incidence of chorioamnionitis after emergency cervical cerclage is 22/44 (50%).this study shows that tissue chorionic amnionitis is an independent risk factor for sPTB less than 28 weeks after emergency cervical cerclage of prolapsed membranes in second pregnancy,Postintrapartum placental tissue chorioamnionitis less than 28 weeks (case group) was 37/39 (94.9) significantly higher than control 34/67 (50.7%),This study divided the delivery week into groups at 28 weeks, the smaller the delivery week, the higher the incidence of chorionic amnionitis, less than 28 weeks of spontaneous preterm birth (case group) neonatal respiratory distress syndrome 31/39 (79.5%) than the control group 30/67 (44.8%), which is basically in agreement with the above report.

In conclusion,In patients with cervical dilation and prolapsed membranes, emergency cerclage is an important intervention to prolong the gestational week of delivery, with a postoperative incidence of sPTB less than 28 weeks of 36.8%, Tissue chorioamnionitis and amniotic membrane are independent risk factor for less than 28 weeks of sPTB after emergency cerclage in middle pregnancy.In this study, it identifies risk factors affecting spontaneous preterm birth at less than 28 weeks after emergency cerclage. Moreover, timely and effective intervention in patients after cervical cerclage to reduce spontaneous preterm birth of less than 28 weeks, Maximize the pregnancy week beyond the risk of last pregnancy loss, It is expected to extend the gestational week to reach fetal viability and reduce complications in preterm newborns.Although most confounders are eliminated in this study, some risk factors may be excluded due to the small sample size, especially in the case group,As this study is a single-enter retrospective clinical study, the statistical process is inevitably biased and has certain limitations, and large samples of multicenter studies are still needed in the next step.

Declarations

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Author contribution:

Zhucan: protocol, data collection, and manuscript writing.Liuyuning:data management, data analysis.

Wuhaiying:project development and manuscript editing.

Conflict of interest All authors declare no conflicts of interest.

Ethical approval The study has been approved by the Ethics Committee at the Henan Provincial People's Hospital

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