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1 Clinical Article

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3 Cervical polyps in early pregnancy are a risk factor for late abortion and  
4 spontaneous preterm birth: A retrospective cohort study

5

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21

22 Keywords: cervical insufficiency, cervical polyp, late abortion, retrospective cohort  
23 study, risk factors, spontaneous preterm birth

24

25 Synopsis: Cervical polyps in early pregnancy are a risk factor for late abortion  
26 and spontaneous preterm birth.

27

28 Abstract: 200 words, Article: 2483 words

29

30

1 **Abstract**

2 **Objective:** The aim of this study was to determine the association between  
3 cervical polyps in early pregnancy and late abortion and spontaneous preterm  
4 birth (SPTB). We also aimed to explore the relationship between cervical polyps  
5 and cervical insufficiency in the second trimester.

6 **Methods:** We conducted a retrospective cohort study of 2,941 singleton pregnant  
7 women between January 2010 and December 2015. The frequency of late  
8 abortion and SPTB (before 28, 34, or 37 weeks of gestation) was compared  
9 between the two groups of 142 (4.8%) patients who had cervical polyps early in  
10 pregnancy (P group) and 2,799 who did not (non-P group). Multivariate analysis  
11 was performed to identify risk factors for late abortion and SPTB.

12 **Results:** The incidence of late abortion and SPTB was significantly higher in the  
13 P group than in the non-P group. Cervical polyps in early pregnancy were  
14 selected as independent risk factors for late abortion and SPTB before 28, 34, or  
15 37 weeks of gestation. The P group had a significantly higher rate of cases  
16 requiring therapeutic cervical cerclage than the non-P group.

17 **Conclusion:** Cervical polyps in early pregnancy are risk factors for late abortion  
18 and SPTB. They are also associated with the occurrence of cervical insufficiency.

## 1 **Introduction**

2       Cervical polyps are reported to occur in 2-5% of women of reproductive age  
3 [1]. Not surprisingly, they are also commonly present in women in early pregnancy  
4 and can cause repeated genital bleeding. However, there are no studies on the  
5 impact of cervical polyps on pregnancy outcomes and no compelling clinical  
6 evidence exists. Miscarriage and preterm birth in the second trimester after  
7 excision of cervical polyps early in pregnancy have been reported in some cases  
8 [2-3]. According to a cohort study on cases of polyps removed during pregnancy,  
9 the rates of late abortion, spontaneous preterm birth (SPTB) before 34 weeks of  
10 gestation, and SPTB before 37 weeks of gestation were 6.8%, 15.1%, and 20.5%,  
11 respectively, which was higher than the general SPTB rate of 5.7% among  
12 pregnant women in Japan [4]. Histopathological examination of cervical polyps  
13 resected during pregnancy showed a higher rate of miscarriage and SPTB before  
14 37 weeks of gestation in the decidual polyp group than in the endocervical polyp  
15 group [5]. Thus, although cases of resected cervical polyps have been reported,  
16 there have been no studies on the effect of cervical polyps on pregnancy  
17 outcomes compared to the non-polyp group or on the effect of cervical polyps  
18 including non-resected cases.

1 We have observed many cases of late abortion and extremely preterm birth  
2 after the diagnosis of cervical polyp during early pregnancy in the obstetric  
3 practice of our high-volume perinatal centers. We also observed cases of  
4 pregnant women with cervical polyps who required therapeutic cervical cerclage  
5 due to a prolapsed fetal membrane in the second trimester. These experiences  
6 led us to speculate that cervical polyps in early pregnancy may be associated  
7 with late abortion and SPTB. Therefore, the present study aimed to determine the  
8 association between cervical polyps found in early pregnancy and subsequent  
9 late abortion and SPTB (before 28, 34, or 37 weeks of gestation). We also aimed  
10 to explore the relationship between cervical polyps and cervical insufficiency  
11 requiring therapeutic cervical cerclage in the second trimester.

12

### 13 **Patients and Methods**

14 A retrospective review was conducted on 4,144 women who delivered at  
15 Sapporo City General Hospital between January 2010 and December 2015. Of  
16 these, 145 women who were referred to the hospital after the second trimester of  
17 pregnancy were excluded from this study. A further 658 women who were  
18 transported to our hospital for delivery in the late pregnancy were excluded. The

1 pregnancies of the remaining 3,341 women were managed from the first trimester  
2 to delivery. Women with multiple pregnancy (n=301), intrauterine fetal death  
3 (n=43), and severe fetal malformation (n=56) were excluded. The remaining 2941  
4 women were enrolled in this study. We classified them into two groups: 142  
5 women with cervical polyps in the first trimester (P group) and 2,799 women  
6 without cervical polyps (non-P group) (Fig. 1).

7 The cervix is always inspected during the first trimester of pregnancy, and a  
8 Pap tests and a chlamydia antigen tests are performed simultaneously. Therefore,  
9 the existence of cervical polyps is confirmed in all women. Pregnancy checkups  
10 in Japan are performed 4-weekly until 22 weeks of pregnancy, 2-weekly until 35  
11 weeks, and weekly after 36 weeks. In this study, cervical polyps were defined as  
12 soft, elastic masses growing from within the cervical canal. They varied in size  
13 from the size of a rice grain to the size of a thumbnail. The diagnosis of cervical  
14 polyps was made by macroscopic examination. The need for polypectomy was  
15 determined by the respective physicians.

16 Obstetric background was investigated for maternal age, pregnancy history,  
17 delivery history, previous late abortion (excluding termination of pregnancy),  
18 SPTB before 34 weeks, history of conization, and bacterial vaginosis (BV).

1 Miscarriages at gestations more than 12 weeks but less than 22 weeks were  
2 classified as late abortions. In this study, miscarriages due to fetal death was  
3 excluded from late abortion. Termination of pregnancy less than 37 week's  
4 gestational age due to maternal complications, hypertensive disorders of  
5 pregnancy, fetal growth restriction, non-reassuring fetal status, and placenta  
6 previa were excluded from SPTB. Hypertensive disorders of pregnancy included  
7 preeclampsia and eclampsia, chronic hypertension, and preeclampsia  
8 superimposed on chronic hypertension. Fetal growth restriction was defined as  
9 weight less than -1.5 standard deviations using the "fetal weight reference values  
10 for Japanese" [6]. Non-reassuring fetal status was defined as an "abnormal  
11 finding" on fetal cardiotocograph during pregnancy or delivery where there was  
12 no certainty that the fetus was well. Placenta previa is a condition in which the  
13 placenta covers partially or completely the internal cervical os. BV was diagnosed  
14 when the Nugent score was seven or more on vaginal secretion gram staining at  
15 the beginning of pregnancy. BV was treated with seven days of self-insertion of  
16 metronidazole vaginal tablets.

17 We compared the frequency of late abortion and SPTB (before 28, 34, and 37  
18 weeks of gestation) as endpoints between the P group and non-P groups. To

1 investigate whether cervical polyps in early pregnancy are an independent risk  
2 factor for late abortion and SPTB (before 28, 34, and 37 weeks of gestation), we  
3 performed a univariate and a multiple logistic regression analysis with known risk  
4 factors, that is, age, multiparity, history of late abortion [7], history of preterm birth  
5 before 34 weeks of gestation [7,8], history of conization [9.10], and the presence  
6 of BV [11] as confounders.

7 In addition, we compared the frequency of cases of cervical insufficiency  
8 requiring therapeutic cervical cerclage in the second trimester between the two  
9 groups. Cervical insufficiency is defined as the inability of the uterine cervix to  
10 retain a pregnancy in the absence of the signs and symptoms of clinical  
11 contractions, labor, or both in the second trimester [12]. Although controversial,  
12 the diagnosis of cervical insufficiency in this study was made when the uterine os  
13 was open or the cervix measured less than 20 mm in length, without overt  
14 infection or inflammation, and in the absence of frequent uterine contractions  
15 before 28 weeks of gestation. Therapeutic cervical cerclage was actively  
16 performed in cases where uterine contractions could be controlled. To determine  
17 the risk factors for therapeutic cervical cerclage, we performed a multiple logistic  
18 regression analysis with the aforementioned risk factors as confounders.



1 Statistical analyses of the obstetric background and pregnancy outcomes were  
2 performed using Fishers exact test or t-test. A P-value of <0.05 was considered  
3 statistically significant. All statistical analyses were conducted using the statistical  
4 analysis software (SPSS, version.22; IBM, Tokyo, Japan).

5 This study was conducted with the approval of the ethical committee of  
6 Sapporo City General Hospital (No. R02-059-735). The requirement for informed  
7 consent was waived owing to the retrospective design of the study.

8

## 9 **Results**

10 Table 1 shows the obstetric background of the subjects. The frequency of late  
11 abortion and SPTB before 34 weeks of gestation was significantly higher in the P  
12 than in the non-P group. On the other hand, there was no difference in the  
13 frequency of parous women, previous conization, or presence of BV.

14 Among 142 women with polyps, resection was performed in 36 cases (25.4%).  
15 Histopathological examination showed that, of the removed polyps, 30 (83.3%)  
16 were decidual polyps and 6 (16.7%) were endocervical polyps. The finding of  
17 inflammatory cell infiltration was observed in many of them. Of the 106 women  
18 who were conservatively managed for polyps, 22 (20.8%) were no longer visible

1 on vaginal examination by 12 weeks, 57 (53.8%) by 22 weeks, and the remaining  
2 27 at delivery.

3 Pregnancy outcomes are shown in Table 2; gestational age and birth weight in  
4 the P and non-P groups were  $37.3 \pm 4.4$  weeks,  $2771 \pm 693$  grams, and  $38.5 \pm$   
5  $2.0$  weeks,  $2910 \pm 474$  g (mean  $\pm$  SD), respectively, with significantly earlier  
6 gestational age at delivery and lower birth weight in the P group. The P group had  
7 a significantly higher incidence of late abortion, and SPTB before 28, 34, and 37  
8 weeks of gestation, all of which were significantly more common in the P than in  
9 the non-P group. Four out of five cases of late abortion in the non-P group  
10 resulted in miscarriage due to membrane rupture or fetal membrane prolapse  
11 after 20 weeks of gestation. On the contrary, in the P group, membrane rupture  
12 or genital bleeding occurred before 16 weeks without cervical enlargement or  
13 shortening of the cervix, leading to earlier miscarriage in all cases. All these late  
14 abortions were associated with pathological chorioamnionitis.

15 Table 3 shows the risk factors identified by a univariate analysis and a multiple  
16 logistic regression analysis for late abortion (a), SPTB before 28 weeks of  
17 gestation (b), SPTB before 34 weeks of gestation (c), or SPTB before 37 weeks  
18 of gestation (d). The independent risk factors identified by a multiple logistic

1 regression analysis for late abortion were history of late abortion (odds ratio [OR]:  
2 23.8; 95% confidence interval [CI]: 4.1-137.5;  $p < 0.001$ ) and cervical polyp (OR:  
3 13.0; 95%CI: 3.3-51.4;  $p < 0.001$ ) in the study of late abortion. History of late  
4 abortion (OR: 10.2; 95%CI: 1.0-100.1;  $p = 0.047$ ), history of SPTB before 34  
5 weeks (OR: 5.2; 95%CI: 1.0-27.3;  $p = 0.049$ ), history of conization (OR: 26.8;  
6 95%CI: 7.5-96.1;  $p < 0.001$ ), and cervical polyp (OR: 4.6; 95%CI: 1.1-18.6;  
7  $p = 0.034$ ) were independent risk factors for SPTB before 28 weeks of gestation.  
8 History of late abortion (OR: 7.9; 95%CI: 1.5-41.1;  $p = 0.014$ ), history of SPTB  
9 before 34 weeks (OR: 6.3; 95%CI: 2.1-18.7;  $p = 0.001$ ), history of conization (OR:  
10 17.8; 95%CI: 7.0-45.2;  $p < 0.001$ ), and cervical polyp (OR: 4.7; 95%CI: 1.9-12.0;  
11  $p = 0.001$ ) were independent risk factors for SPTB before 34 weeks of gestation.  
12 History of late abortion (OR: 3.7; 95%CI: 1.2-11.5;  $p = 0.024$ ), history of SPTB  
13 before 34 weeks (OR: 2.5; 95%CI: 1.2-5.5;  $p = 0.015$ ), history of conization (OR:  
14 7.0; 95%CI: 3.7-13.2;  $p < 0.001$ ), and cervical polyp (OR: 3.1; 95%CI: 1.8-5.4;  
15  $p < 0.001$ ) were independent risk factors for SPTB before 37 weeks of gestation.

16 The incidence of cervical insufficiency requiring therapeutic cervical cerclage  
17 in the second trimester was compared between the two groups. The frequency  
18 was 5.6% in the P group compared to 0.7% in the non-P group, which was

1 significant ( $p < 0.001$ ). The independent risk factors identified by a multiple logistic  
2 regression analysis for cervical insufficiency requiring therapeutic cerclage were  
3 history of late abortion (OR: 18.6; 95%CI: 5.2-66.7;  $p < 0.001$ ), history of SPTB  
4 before 34 weeks of gestation (OR: 6.3; 95%CI: 2.1-19.4;  $p = 0.001$ ), and cervical  
5 polyp (OR: 5.7; 95%CI: 2.3-14.2;  $p < 0.001$ ).

6

## 7 **Discussion**

8 We demonstrated for the first time in a retrospective cohort study that cervical  
9 polyps in early pregnancy are a risk factor for late abortion and SPTB.

10 Two complications were found in pregnant women with cervical polyps in early  
11 pregnancy that led to late abortion or SPTB: one was the onset of labor, which  
12 led to abortion or preterm birth due to infection. The other was cervical  
13 insufficiency. We hypothesize the following as mechanisms for the increased risk  
14 of preterm birth in cases of cervical polyps. Firstly, cervical polyps become the  
15 site of infection, causing ascending infection and chorioamnionitis [13], leading to  
16 the onset of labor and membrane rupture [14]. Secondly, degeneration and  
17 necrosis of cervical polyps cause inflammatory cytokines to cause cervical  
18 ripening [15], resulting in cervical insufficiency. Inflammatory cells associated with

1 cervical polyps produce proteases [16] which cause fragility of the fetal  
2 membranes, leading to membrane rupture. The association between cervical  
3 polyps and chorioamnionitis or cervical polyps and preterm birth has already been  
4 reported [4,5,17]. Kanayama et al. measured cervical mucus granulocyte  
5 elastase activity and cervical mucus white blood cell count in mid-pregnancy and  
6 found that they were significantly higher in the cervical polyp group, and were  
7 lower after polypectomy. Furthermore, histopathological examination of the  
8 placenta indicated an association between cervical polyps and histological  
9 chorioamnionitis [17]. Immunohistochemistry has shown the localization of  
10 elastase and granulocyte migration from the stroma to the cervical lumen [14].  
11 These have revealed inflammation in the cervical canal due to cervical polyps.  
12 However, the details of the chemical mediators associated with cervical polyps in  
13 pregnancy have not been elucidated. Rather, we hypothesize that the cervix itself,  
14 where cervical polyps arise, may have some potential problems. The local  
15 environment of the cervix itself may be responsible for cervical maturation and  
16 failure of infection defense. From the analysis of the cases of late abortion, local  
17 inflammation associated with polyps was already induced early in pregnancy,  
18 suggesting that this may have led to early miscarriage from deciduitis or

1 chorioamnionitis.

2 In the present study, cervical polyps, history of late abortion, and SPTB before  
3 34 weeks of gestation were risk factors for cervical insufficiency requiring  
4 therapeutic cervical cerclage. The American College of Obstetricians and  
5 Gynecologists guidelines recommend transvaginal ultrasound cervical length  
6 assessment at 16-24 weeks for pregnant women with a history of preterm birth.  
7 In addition, cervical cerclage can be recommended for singleton pregnancies with  
8 a history of preterm birth less than 34 weeks and cervical length shortening of  
9 less than 25 mm before 24 weeks [12]. In the current study, of the eight women  
10 who underwent therapeutic cervical cerclage in the P group, shortening of the  
11 cervix appeared at 17 and 18 weeks of gestation in two of the eight patients,  
12 respectively. Three patients had prolapse of the fetal membrane at around 20  
13 weeks of gestation. In these cases, prompt therapeutic cervical cerclage resulted  
14 in continued pregnancy and a healthy baby. Therefore, we suggest that, in  
15 pregnant women with cervical polyps in early pregnancy, regardless of previous  
16 history of SPTB, cervical findings should be rigorously evaluated, and therapeutic  
17 cervical cerclage should be considered if cervical shortening is apparent and  
18 progressive.

1 It should be noted that in the majority of conservatively managed cases, polyps  
2 spontaneously regressed by the first half of the pregnancy and were no longer  
3 visible from the external uterine os, but it should also be noted that SPTB and  
4 cervical enlargement occurred later in the pregnancy. In other words, we would  
5 like to emphasize that cervical polyps that are no longer visible during pregnancy  
6 do not reduce the risk of SPTB and cervical insufficiency.

7 The limitation of this study is that we did not perform a histopathological  
8 examination for cervical polyps in non-resected cases. Since cervical polyps are  
9 infrequent but can have malignant findings [18], it is reasonable to resect them  
10 and make a histological diagnosis. Conversely, although it is difficult to completely  
11 exclude malignancy [19], the frequency of malignancy in cervical polyps in  
12 women of reproductive age is so low [20-21] that we believe that conservative  
13 management is acceptable if the cervical polyp surface is also sampled by the  
14 Pap test and is not abnormal. The relationship between polyp histological type  
15 and the occurrence of preterm birth should also be investigated in the future.

16 In conclusion, cervical polyps in early pregnancy are an independent risk  
17 factor for late abortion and SPTB. The risk was high at all gestations of preterm  
18 birth and comparable to that of a history of preterm birth. Cervical polyps are also

1 a risk factor for cervical insufficiency, as many cases of cervical insufficiency in  
2 the second trimester require therapeutic cervical cerclage. Therefore, strict  
3 cervical length surveillance with transvaginal ultrasound is necessary in pregnant  
4 women with cervical polyps in early pregnancy. It should also be recognized that  
5 these risks are still high, even if polyps are no longer visible during pregnancy.

6

#### 7 **Author contributions**

8 Study concept and design: EH; acquisition of data: EH, KK, KN; Analysis and  
9 interpretation of data: EH, YE; drafting of the manuscript: EY, YE; Critical revision  
10 of the manuscript for important intellectual content: EH, YE, KO. All authors have  
11 read and approved the manuscript.

12

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15

#### 16 **Conflicts of interest**

17 The authors declare that they have no conflicts of interest.

18

19



## 1   **References**

- 2   1. Farrar HK, Nedoss BR. Benign tumors of the uterine cervix. *Am J Obstet Gynecol.*  
3       1961;81:124-137.
- 4   2. Aoki S, Hayashi M, Seki K, Hirahara F. Preterm premature rupture of membrane after  
5       polypectomy using an Endoloop polydioxanone suture II(TM). *Clin Case Rep.* 2016;4:331-  
6       332.
- 7   3. Levin G, Rottenstreich A. 2nd trimester miscarriage following decidual polypectomy. *Eur J*  
8       *Obstet Gynecol Reprod Biol.* 2018;225:262-263.
- 9   4. Fukuta K, Yoneda S, Yoneda N, et al. Risk factors for spontaneous miscarriage above 12  
10       weeks or premature delivery in patients undergoing cervical polypectomy during pregnancy.  
11       *BMC Pregnancy Childbirth.* 2020;20:27.
- 12   5. Tokunaka M, Hasegawa J, Oba T, et al. Decidual polyps are associated with preterm birth in  
13       cases of attempted uterine cervical polypectomy during the first and second trimester. *J*  
14       *Matern Fetal Neonatal Med.* 2015;28:1061-1063.
- 15   6. Perinatal Committee.[Standardization of Fetal Ultrasound Measurements and Japanese  
16       Reference Values] *Nihon Sanka Fujinka Gakkai zasshi.* 2005;57:92-117.
- 17   7. Shiozaki A, Yoneda S, Nakabayashi M, et al. Multiple pregnancy, short cervix, part-time  
18       worker, steroid use, low educational level and male fetus are risk factors for preterm birth in  
19       Japan: a multicenter, prospective study. *J Obstet Gynaecol Res.* 2014;40:53-61.
- 20   8. Yamashita M, Hayashi S, Endo M, et al. Incidence and risk factors for recurrent spontaneous  
21       preterm birth: a retrospective cohort study in Japan. *J Obstet Gynaecol Res.* 2015;41:1708-  
22       1714.
- 23   9. Sadler L, Saftlas A, Wang W, Exeter M, Whittaker J, McCowan L. Treatment for cervical  
24       intraepithelial neoplasia and risk of preterm birth. *JAMA.* 2004;291:2100-2106.
- 25   10. Bevis KS, Biggio JR. Cervical conization and the risk of preterm birth. *AM J Obstet Gynecol.*  
26       2011;205:19-27.
- 27   11. Hillier SL, Nugent RP, Eschenbach DA, et al. Association between bacterial vaginosis and  
28       preterm birth of a low-birth-weight infant. The Vaginal Infections and Prematurity Study Group.  
29       *New Engl J Med.* 1995;333:1737-1742.
- 30   12. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin No.142:  
31       cerclage for the management of cervical insufficiency. *Obstet Gynecol.* 2014;123:372-379.
- 32   13. Goldenberg RL, Hauth JC, Andrews WW. Intrauterine infection and preterm birth. *New Engl*  
33       *J Med.* 2000;342:1500-1507.
- 34   14. So T. [The role of matrix metalloproteinases for premature rupture of the membranes]. *Nihon*  
35       *Sanka Fujinka Gakkai zasshi.* 1993;45:227-233.
- 36   15. Kanayama N, Terao T. The relationship between granulocyte elastase-like activity of cervical

- 1 mucus and cervical maturation. *Acta Obstet Gynecol Scand*. 1991;70:29-34.
- 2 16. Keelan JA, Blumenstein M, Helliwell RJ, Sato TA, Marvin KW, Mitchell MD. Cytokines,  
3 prostaglandins and parturition--a review. *Placenta*. 2003;24 Suppl A:S33-S46.
- 4 17. Kanayama N, Terao T. [The relation between granulocyte elastase activity in cervical mucus  
5 and gestational cervical polyp]. *Nihon Sanka Fujinka Gakkai zasshi*. 1991;43:26-30.
- 6 18. Berzolla CE, Schnatz PF, OSullivan DM, Bansal R, Mandavilli S, Sorosky JI. Dysplasia and  
7 malignancy in endocervical polyps. *J Womens Health (Larchmt)*. 2007;16:1317-1321.
- 8 19. Madej J, Krzysiek J, Basta A, Madej J. Decidual ectopy on the uterine cervix. The diagnostic  
9 and clinical considerations. *Mater Med Pol*. 1989;21:20-26.
- 10 20. MacKenzie IZ, Naish C, Rees CM, Manek S. Why remove all cervical polyps and examine  
11 them histologically? *BJOG*. 2009;116:1127-1129.
- 12 21. Younis MT, Iram S, Anwar B, Ewies AA. Women with asymptomatic cervical polyps may not  
13 need to see a gynaecologist or have them removed: an observational retrospective study of  
14 1126 cases. *Eur J Obstet Gynecol Reprod Biol*. 2010;150:190-194.

15  
16  
17

## 18 **Figure legend**

### 19 **Figure 1**

20 Flow chart of patient selection

Table 1 Obstetric background according to the presence or absence of cervical polyp

Characteristic	Polyp (n=142)	No polyp (n=2799)	p-value
Maternal age (years)	34.7 ± 4.2	33.0 ± 5.1	<0.001
Multipara	76 (53.5)	1360 (48.6)	0.264
History of late abortion	4 (2.8)	20 (0.7)	0.026
History of spontaneous preterm birth before 34 week's gestational age	12 (8.5)	55 (2.0)	<0.001
History of conization	5 (3.5)	54 (1.9)	0.206
Bacterial vaginosis	20 (14.1)	311 (11.1)	0.276

Mean ± SD, number (%)

SD: standard deviation

Table 2 Pregnancy outcomes of women according to the presence or absence of cervical polyp

Characteristics	Polyp (n=142)	No polyp (n=2799)	p-value
Gestational age at delivery (weeks)	37.3 ± 4.4	38.5 ± 2.0	0.001
Birth weight (g)	2771 ± 693	2910 ± 474	<0.001
Late abortion	4 (2.8)	5 (0.2)	0.001
Spontaneous preterm birth before 28 week's gestational age	3 (2.1)	9 (0.3)	0.018
Spontaneous preterm birth before 34 week's gestational age	7 (4.9)	22 (0.8)	<0.001
Spontaneous preterm birth before 37 week's gestational age	19 (13.4)	115 (4.1)	<0.001

Mean ± SD, number (%)

SD: standard deviation

Table 3 Risk factors identified by a univariate analysis and a multiple logistic regression analysis of for late abortion or spontaneous preterm birth

factors	Univariate analysis		Multivariate analysis	
	Odds ratio (95% CI)	p-value	Odds ratio (95% CI)	p-value
(a) Late abortion				
Age	1.1 (0.9-1.2)	0.475		
Multiparity	0.3 (0.1-1.3)	0.104		
History of late abortion	37.8 (7.4-192.2)	<0.001	23.8 (4.1-137.5)	<0.001
History of spontaneous preterm birth before 34 week's gestational age	5.4 (0.7-44.0)	0.113		
History of conization	6.2 (0.8-50.3)	0.088		
Bacterial vaginosis	2.3 (0.5-10.9)	0.310		
Cervical polyp	16.2 (4.3-61.0)	<0.001	13.0 (3.3-51.4)	<0.001
(b) Spontaneous preterm birth before 28 week's gestational age				
Age	1.0 (0.9-1.1)	0.627		
Multiparity	0.7 (0.2-2.1)	0.512		
History of late abortion	11.5 (1.4-92.7)	0.022	10.2 (1.0-100.1)	0.047
History of spontaneous preterm birth before 34 week's gestational age	8.8 (1.9-41.0)	0.006	5.2 (1.0-27.3)	0.049
History of conization	26.1 (7.6-83.4)	<0.001	26.8 (7.5-96.1)	<0.001
Bacterial vaginosis	0.7 (0.1-5.6)	0.749		
Cervical polyp	6.7 (1.8-25.0)	0.005	4.6 (1.1-18.6)	0.034
(c) Spontaneous preterm birth before 34 week's gestational age				
Age	1.0 (0.9-1.1)	0.598		
Multiparity	0.7 (0.3-1.4)	0.292		
History of late abortion	9.7 (2.2-43.4)	0.003	7.9 (1.5-41.1)	0.014
History of spontaneous preterm birth before 34 week's gestational age	9.6 (3.5-25.9)	<0.001	6.3 (2.1-18.7)	0.001
History of conization	17.5 (7.2-42.8)	<0.001	17.8 (7.0-45.2)	<0.001
Bacterial vaginosis	1.3 (0.4-3.7)	0.665		
Cervical polyp	6.5 (2.7-15.6)	<0.001	4.7 (1.9-12.0)	0.001
(d) Spontaneous preterm birth before 37 week's gestational age				
Age	1.0 (0.9-1.0)	0.680		

Multiparity	0.7 (0.5-1.0)	0.063		
History of late abortion	4.3 (1.4-12.7)	0.009	3.7 (1.2-11.5)	0.024
History of spontaneous preterm birth before 34 week's gestational age	3.4 (1.7-7.0)	0.001	2.5 (1.2-5.5)	0.015
History of conization	7.2 (3.8-13.4)	<0.001	7.0 (3.7-13.2)	<0.001
Bacterial vaginosis	1.2 (0.7-1.9)	0.592		
Cervical polyp	3.6 (2.1-6.0)	<0.001	3.1 (1.8-5.4)	<0.001

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CI: confidence interval

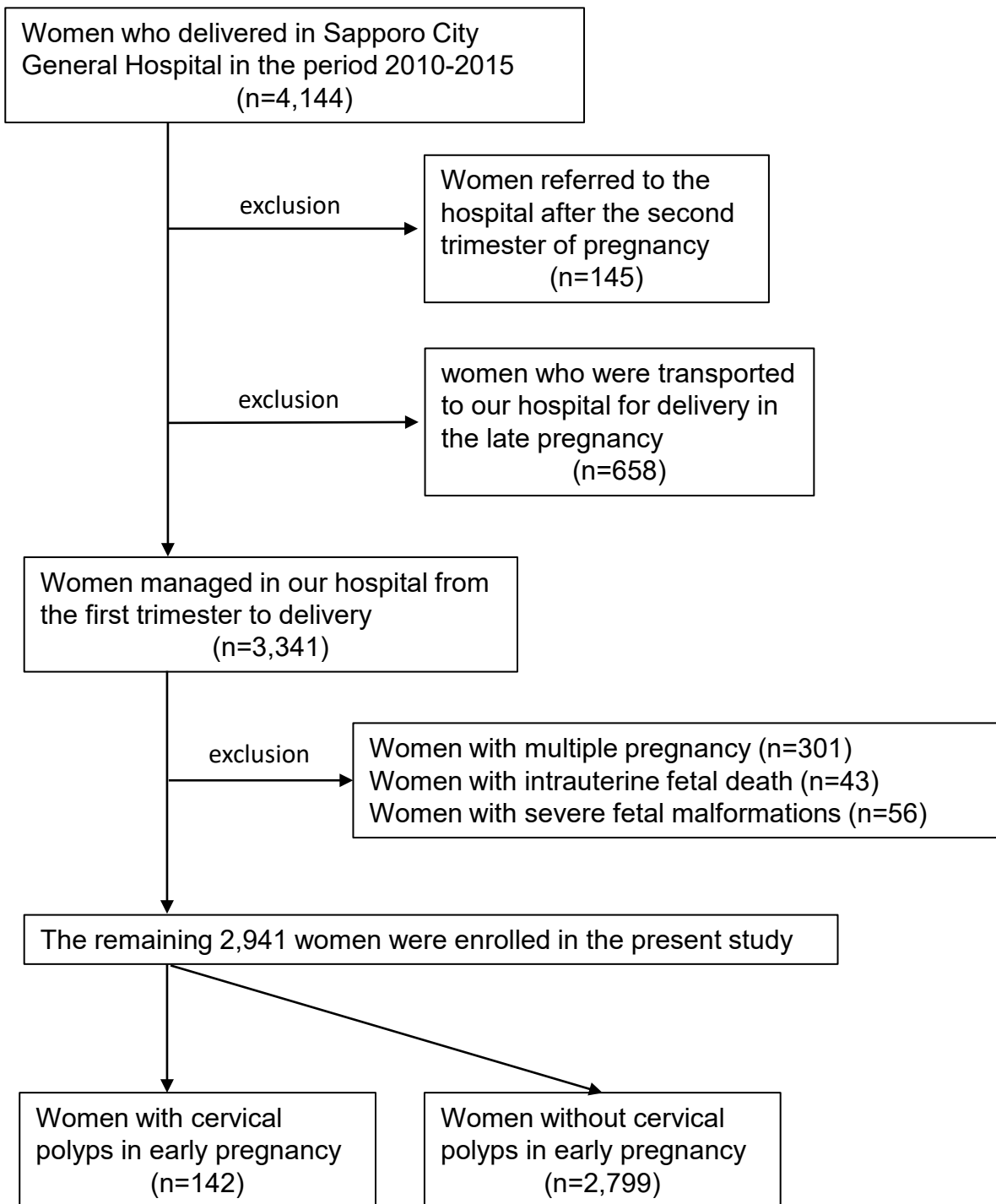


Figure 1