



A RETROSPECTIVE STUDY OF OUR NINE YEARS OF EXPERIENCE WITH ABNORMAL PLACENTATION — RISK FACTORS AND PREGNANCY OUTCOMES

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ABSTRACT:

Purpose: Placenta previa and morbidly adherent placenta are life-threatening conditions that necessitate close monitoring during pregnancy and can result in increased ante- and intrapartum complications. This study aims to evaluate the frequency of placental disorders in our population, reveal the impact of the known risk factors on maternal morbidity, and study new predisposing conditions and their effects on pregnancy outcomes.

Materials and Methods: We performed a single-centered retrospective study in which we analyzed 330 women diagnosed with abnormal placentation—placenta previa and placenta accreta spectrum (PAS). We included all the women that gave birth at Nadezhda Hospital, from March 2013 to August 2021. We processed the data using the chi-square test, Cramer's V test, and cross-section analysis.

Results: The frequency of placenta previa in our population is higher than the worldwide reported data. We were unable to demonstrate the connection between previous uterine manipulations (c-section, D&C, operative hysteroscopy, etc.) and the occurrence of higher-grade placenta previa in our population. However, the more surgeries performed, the more complications during pregnancy and delivery occur (antepartum bleeding, increased blood loss, surgical management of postpartum hemorrhage, peripartum hysterectomy). Pregnancies following assisted reproductive techniques (ART) are at a three-times higher risk of placenta previa. Endometriosis determines a greater risk of developing an abnormally adherent placenta.

Conclusion: More prospective studies need to be performed to define the exact risk factors for abnormal placentation that affect the Bulgarian population. A better understanding of the condition will lead to better management of higher-risk pregnancies, thus reducing maternal and fetal morbidity.

Keywords: placenta praevia, placenta accreta spectrum, risk factors, pregnancy outcomes,

INTRODUCTION

Abnormal placentation is a serious obstetrical disorder that increases maternal and fetal morbidity and mortality. A placenta previa is diagnosed when the placenta develops in close proximity (less than 2 centimeters) to the internal cervical os or covers it to some extent [1]. 'Minor' placenta previa is defined when the edge of the placenta lies adjacent to the internal os or it ends exactly at it. When the os is partially or fully covered, it is defined as 'major' placenta previa [1]. When there is abnormal penetration into the myometrium (some authors describe it as abnormal myometrial invasion), we refer to this condition as the placenta accreta spectrum (PAS). Depending on the depth of villous invasion there are three subtypes – accreta, increta, and percreta and each one might be focal or can engage the whole surface of the placenta [1, 2]. Although it was described for the first time around 400 B.C. by Hippocrates [3], the etiology of placenta previa is still unknown. In the past decades, many risk factors that contribute to abnormal placentation have been revealed – maternal age, parity, cigarette smoking, previous cesarean sections, and uterine manipulations (myomectomy, D&C, etc.) [4, 5]. Some new factors, such as assisted reproduction techniques and endometriosis, have been studied lately [6, 7]. The frequency rate of placenta previa varies widely from country to country due to the subjectivity of diagnosis and the lack of a unitary registration system. The overall occurrence rate is 5,2 per 1000 pregnancies, with Asian studies having the highest prevalence—12,2:1000 [4, 5]. There is no registry form in Bulgaria, so the prevalence of the condition is unknown. In "Nadezhda" Hospital, the rate of placenta previa is 2,27%, of which 13,6 % are defined as 'major' placenta praevia, and the cases with both placenta previa and PAS represent 0,09% of the studied women. In our country, these conditions are highly associated with preterm delivery and prematurity, delivery complications such as increased blood loss, and the need for subsequent surgical management of peripartum hemorrhage. When delivery of unsuspected placenta praevia or PAS takes place at a tertiary health center there is a great risk of a fatal outcome for the mother and the baby.

MATERIALS AND METHODS:

Data was collected from the delivery records, antenatal ultrasound protocols, MRI protocols, surgery protocols, and histopathological results. We obtained and analyzed the information of every woman that had delivered her child in “Nadezhda” Hospital, from March 2013 until August 2021, and was diagnosed ante- or intrapartum with abnormal placentation. In that period, 14 527 women gave birth at our hospital. Of them, 330 had varying degrees of placenta previa, and 14 were concomitant with a PAS disorder. As inclusion criteria, we defined the following requirements: ultrasound findings of the placenta placed at less than 2 centimeters from the internal os; persistence of the findings after 32 weeks of gestation; MRI scans showing abnormal invasion of the placenta into the myometrium. We excluded all the women who had been diagnosed with placenta praevia early in the pregnancy, which resolved during the third trimester. We analyzed the data using 16 criteria: age, parity, cigarette smoking, previous C-section, previous myomectomy, ART, endometriosis, etc. Some of them are well-known risk factors related

to abnormal placentation, and others are understudied conditions that might contribute to placenta praevia or PAS. We used descriptive analysis, chi-square test, and Cramer’s V test for analyzing the criteria concerning only the studied patient. Cross-section analysis we used for the statistical data processing of the whole population of 14 527 women.

RESULTS:

Well-known risk factors

We performed descriptive analysis on 330 women diagnosed with abnormal placentation for the well-known risk factors: parity, number of fetuses, cigarette smoking, and previous cesarean delivery. The age range of the patients was from 21 to 49 years, with a mean age of 34.8 y. For nearly 80% of the women, this was their first pregnancy. 12.1% of the multiparous women had a previous normal delivery, and 8.2% of them had undergone cesarean delivery in the previous pregnancy. Due to the lack of information on cigarette smoking, no conclusion can be stated about the importance of this risk factor. (Table 1).

Table 1. Distribution according to well-known risk factors

Risk factors		Patients (n=330)	%
Parity	Primiparity	263	79,7
	Multiparity	67	20,3
Previous deliveries	No deliveries	263	79,7
	Normal delivery	40	12,1
	Cesarean delivery	27	8,2
Number of fetuses	One fetus	325	98,5
	Multiple fetuses	5	1,5
Cigarette smoking	No data	129	39,1
	No smoking	162	49,1
	Less than 10 cig/day	23	7
	More than 10 cig/day	1	0,3
	Stopped before pregnancy	15	4,5

As for the number of fetuses, it gives an impression that only 1% of pregnancies were multifetal. It is known that twin pregnancy is a risk factor for placenta praevia due to the larger surface of the developing one or two placentas [8]. Most of the ultrasound-diagnosed placenta praevia resolved after 32 weeks of gestation, however, there is a tendency that dichorionic twin pregnancies are at greater risk compared to monochorionic or singleton pregnancies [9]. We performed a cross-sectional analysis encompassing all 14 527 women that gave birth at the hospital for the revised period, of which 940 carried twins, and only 5 of them were diagnosed with placenta praevia. The result showed that multifetal pregnancy is not a risk factor for the occurrence of placenta previa for our population: *OR* < 1 (95% *CI*: 0,0897 to 0.5274, *p*=0.0007).

Previous uterine manipulation as a risk factor for abnormal placentation

We decided to study the implication of *previous uterine manipulation* as a risk factor in our population. For a more accurate analysis, we divided this group into two subgroups. In the first subgroup, we included all women that had experienced one or more uterine manipulations for discontinuation of pregnancy due to the following reasons: spontaneous pregnancy loss, medically indicated termination of pregnancy up to 26 weeks of gestation, and intentional discontinuation of pregnancy. (Table 2).

Table 2. Distribution according to the number and reasons for miscarriages

Criteria	Patient (n=300)	%
Previous miscarriages 330	100	
No miscarriages	215	65,2
One miscarriage	88	26,7
More than one miscarriage	27	8,2
Reasons for miscarriages 330	100	
No miscarriages	215	65,2
Intentional abortion	27	8,2
Medically indicated abortion	24	7,3
Spontaneous miscarriage	50	15,2
Different reasons for termination of pregnancy	14	4,2

The second subgroup consisted of women that had undergone one or more uterine manipulations - D&C, operative hysteroscopy, hysterotomy, cervical conization, or trachelectomy, related to any of the following uterine

pathologies - abnormal bleeding, uterine fibroids, adenomyosis, endometrial or cervical polyps, intrauterine adhesions, dysmorphic uterus, operative delivery. (Table 3).

Table 3. Distribution according to previous uterine manipulations

Previous uterine manipulations	Patient (n=330)	%
None	225	68,2
Operative hysteroscopy/ D&C	52	15,8
Uterotomy (myomectomy, Cesarean delivery)	28	8,5
Conization of cervix/ Trachelectomy	7	2,1
More than one procedures	18	5,5
Total	330	100

We performed chi-square and Cramer's V tests for the data analysis, and we conclude that there is no statistical relationship between the occurrence of a higher grade placenta previa and the number and the reasons for the occurrence of miscarriages ($\chi^2=10.814$, $df=6$, $p=0.094$; $\chi^2=11.518$, $df=12$, $p=0.485$), nor is there a relationship between the number and the type of the performed uterine manipulations and the mentioned placental pathology ($\chi^2=18.070$, $df=12$, $p=0.114$). There is, however, a significant relationship between the prior uterine manipulations

and the occurrence of PAS disorders (number of miscarriages, $\chi^2=17.038$, $df=6$, $p=0.009$, $Cramers =0.161$; reason for the miscarriage, $\chi^2=34.655$, $df=12$, $p=0.001$, $Cramers =0.187$; uterine pathology, $\chi^2=39.043$, $df=12$). There is not even one case of PAS disorder among the women who had induced abortions. On the contrary, in the group with medically indicated abortion, the risk of abnormal placentation is almost 3 times higher (11 %) compared to the women with spontaneous miscarriages (4 %). (Tables 4 and 5).

Table 4. Distribution according to the number of miscarriages and PAS disorder

PAS disorders	History of miscarriages			Total
	(number, %)			
	No miscarriages	One miscarriage	More than one miscarriages	
Pl. accreta	3 (50,0%)	1 (16,7%)	2 (33,3%)	6
Pl. increta	0 (0,0%)	0 (0,0%)	1 (100,0%)	1
Pl. percreta	4 (57,1%)	2 (28,6%)	1 (14,3%)	7
None	208 (65,8%)	85 (26,9%)	23 (7,3%)	316
Total	215 (65,2%)	88 (26,7%)	27 (8,2%)	330
χ^2	389.033	158.477	52.259	
Df	2	2	3	
P	0.000	0.000	0.000	

Table 5. Distribution according to the reason for the occurrence of miscarriage and PAS disorder

PAS disorder	Reason for miscarriage					Total
	No miscarriages	Induced termination of pregnancy	Medically indicated abortion	Spontaneous miscarriage	More than one reason	
Pl. accreta	3 (50.0%)	0 (0.0%)	2 (33.3%)	0 (0.0%)	1 (16.7%)	6
Pl. increta	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (100.0%)	1
Pl. percreta	4 (57.1%)	0 (0.0%)	1 (14.3%)	2 (28.6%)	0 (0.0%)	7
None	208 (66.1%)	27 (8.5%)	22 (7.0%)	47 (14.9%)	12 (3.8%)	316
Total	215 (65.2%)	27 (8.2%)	27 (8.2%)	49 (14.8%)	14 (4.2%)	330
χ^2	389.033	This variable is constant. Chi-Square Test cannot be performed.	33.680	41.327	3 cells (100.0%) have expected frequencies of less than 5. The minimum expected cell frequency is 4.7.	

Another significant finding is that with the increase in the number of preexisting uterine surgeries, the chances of complications arising out of delivery are getting higher - greater blood loss, the need for surgical hemostasis, peripartum hysterectomy ($\chi^2=27.205$, $df=6$, $p=0.000$, $Cramer's=0.203$). Six women (5,7 %) of the group with prior uterine manipulations underwent peripartum hysterectomies. From the same group, 8,6 % (9 women) needed Bakrii Balloon application for intraoperative coping with excessive blood loss. Compared to the group with no previous uterine

surgeries, it is 3 times higher (6 women, 2,8 %).

Every myometrial or endometrial scarring is a risk factor not only for abnormal placentation but for bleeding during pregnancy ($\chi^2=16.888$, $df=6$, $p=0.010$, $Cramers=0.160$). Twelve of the women experienced genital bleeding during the whole pregnancy, 41 of the women had bleeding before 24 weeks of gestation, and 40 women had it in the second half of the pregnancy. Prior operative hysteroscopies seem to have a strong impact on this complication. (Table 6).

Table 6. Distribution of the patient with antepartum bleeding according to the degree of placenta previa, prior miscarriages and surgeries of the uterus

Factors	Genital bleeding during pregnancy			
	None (n=237)	Before 24 w. (n=41)	After 24 w. (n=40)	During the whole pregnancy (n=12)
Degrees of pl. previa				
Low-lying placenta	12 (5.1%)	3 (7.3%)	0 (0.0%)	1 (8.3%)
Pl. praevia marginalis	199 (84.0%)	30 (73.2%)	28 (70.0%)	8 (66.7%)
Pl. previa partialis	5 (2.1%)	4 (9.8%)	4 (10.0%)	0 (0.0%)
Pl. previa totalis	21 (8.9%)	4 (9.8%)	8 (20.0%)	3 (25.0%)
Prior miscarriages				
None	159 (67.1%)	26 (63.4%)	22 (55.0%)	8 (66.7%)
One	64 (27.0%)	9 (22.0%)	12 (30.0%)	3 (25.0%)
More than one	14 (5.9%)	6 (14.6%)	6 (15.0%)	1 (8.3%)
Prior uterine surgeries				
None	172 (72.6%)	20 (48.8%)	28 (70.0%)	5 (41.7%)
Hysteroscopy/ D&C	35 (14.8%)	7 (17.1%)	5 (12.5%)	5 (41.7%)
Myomectomy/c-section	17 (7.2%)	7 (17.1%)	2 (5.0%)	2 (16.7%)
Conization/trachelectomy	2 (0.8%)	2 (4.9%)	3 (7.5%)	0 (0.0%)
More than one	11 (4.6%)	5 (12.2%)	2 (5.0%)	0 (0.0%)

Use of ART as a risk factor for abnormal placentation

In recent years, more and more attention has been drawn to the role of the emerging use of assisted reproductive techniques in obstetrical complications. It has been proven that women who are conceived by ART are at a

greater risk of developing preeclampsia, hypertension during pregnancy, placental abruption, and placenta previa [6]. We decided to study the impact of ART on our patients. We included all the women that achieved pregnancy by IVF or ICSI methods, and we performed a cross-sectional analysis. Of the 330 women with placenta previa, 144 were con-

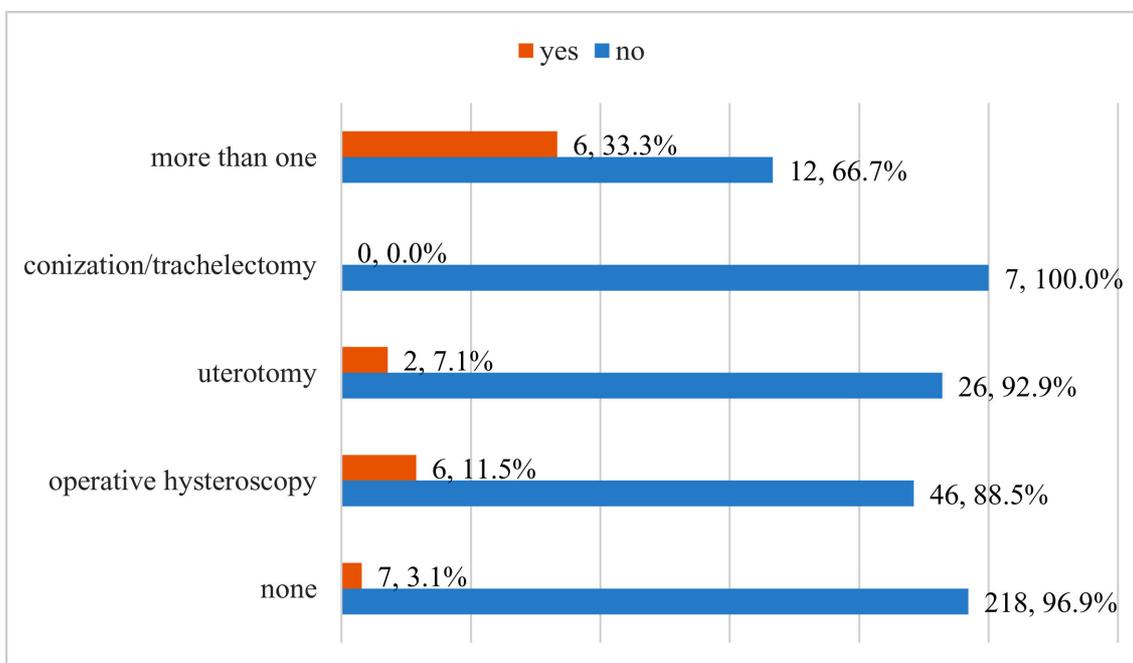
ceived by ART – 5 % of all the women who were conceived with ART and gave birth at our hospital. Most of the women (70,1%) were in the age range of 31–40 years old. 89 of them did not have previous miscarriages (61.8%) or surgical interventions of the uterus (53.5%, 77). 46.6% of them were diagnosed with idiopathic infertility. We performed a cross-sectional test encompassing all 14 527 women, and we found that women conceived with ART are exposed to a three-times higher risk of the occurrence of placenta praevia OR=3,3 (95% CI: 2,6410–4,1116, p 0,0001) and RR 3,18 (95% CI: 2,5678 – 3.9347). Similar results can find in the meta-analyzes of M.Karami et al. - OR was 2.67 (95% CI: 2.01, 3.34), and RR was 3.62 (95% CI: 0.21, 7.03), which proves the universal importance of ART [10]. Most certainly, this is a collective factor that reflects the importance of the age of the woman, different reproductive techniques that had been used, accompanying gynecological conditions that demand conservative or surgical treatment,

and other factors that are still undiscovered [10, 11].

Preexisting endometriosis as a risk factor for abnormal placentation

Endometriosis is a chronic condition that affects around 10% to 15 % of women of reproductive age [12], and around 30 % of the women diagnosed with this pathology suffer from reproductive failure [13]. It is clear now that this condition induces major endometrial changes that can lead to preterm birth, bleeding during the pregnancy, growth restriction of the fetus, and placental abnormalities [7, 14]. This dependency appears to be more pronounced during the first pregnancy. In the population that we investigated, 21 of the women (6.36%) had been previously diagnosed with endometriosis, and 16 of them (76.1%) had conceived with IVF. We observed that women with more than one uterine manipulation had been diagnosed with endometriosis more frequently (fig. 1).

Fig. 1. Distribution of the women due to previous uterine surgeries and endometriosis



We performed chi-square and V'Cramer tests and we found a statistically significant relationship between endometriosis and the occurrence of PAS disorders. ($\chi^2=16.757$, $df=3$, $p=0.001$, $Cramer's=0.225$). The same conclusion we found in the meta-analyzes performed by S. Matsuzaki et al. [15] Not only did they prove this relationship, but they stated that most surely there is an association between endometriosis, the need for ART, and the occurrence of placenta praevia and PAS disorders in these patients.

DISCUSSION:

This research aimed to establish the frequency of abnormal placentation in the patient of Nadezhda hospital, analyze the risk factors that have the greatest impact on the occurrence of the placenta praevia and PAS disorders,

and suggest some new risk factors. To describe the contingent of our hospital, we must say that these are mostly women between 30 and 40 years old, most of them were primiparas, and only 8,2 % had prior operative delivery. We could not manage to prove that previous c-section and cigarette smoking increase the frequency of placenta praevia, as it is stated in several studies [1, 2, 4, 6].

In terms of multiple pregnancies, we've done cross-sectional analyses of all women who gave birth in the hospital, and we've proven that twin pregnancy is not a risk factor. In contrast to our findings, in the retrospective study of M. Weis et al., the authors show a significantly higher risk of placenta praevia in dichorionic twin pregnancies compared with singleton pregnancies [9].

We obtained quite controversial results on previous uterine surgeries as a risk factor for abnormal placentation.

We have failed to prove that previous myomectomies, cesarean sections, operative hysteroscopy, or other uterine manipulations can lead to a higher degree of placenta previa. In their meta-analysis, A. Faiz and C. Ananth clearly outlined the relationship between prior manipulation of the uterus (c-section and abortions) and the higher chances of placenta previa [8]. We only succeeded in finding a significant relationship between previous surgeries performed for abortion or uterine pathology and PAS disorders. An interesting fact is that women with a previously medically indicated abortion are three times more likely to suffer from abnormal placentation. The aforementioned meta-analysis indicates that women with spontaneous abortions have a higher risk of placenta previa, followed by women with induced abortions [8]. In our population, not even one of the women who had induced abortion had PAS abnormality. When there are previous uterine lesions, there is a significant increase in the severity of intraoperative complications - mostly excessive bleeding. The greater the number of manipulations, the greater the severity of the complication.

An intriguing new risk factor for abnormal placentation is ART. The results from the papers of Romundstad L. B. [16], Karami M. [10], and Slavov S. [11], show that the implication of ART as a risk factor for abnormal placentation cannot be underestimated – between 2 and 6 times greater chances of placenta praevia. We performed cross-sectional analyses, and we confirmed their results. In our population, women who conceived with ART are at three times higher risk of developing placenta previa. We assume that the results we present are of high quality and that Nadezhda Hospital is one of the major reproductive centers in our country. We were unable to determine why ART has such a large impact on abnormal placentation – is it because women who require assisted reproduction are older, have various diseases of the reproductive system, or it is due to different techniques of embryo transfer or endometrial priming, which affect the placentation. Certain risk factors have not yet been identified. In the retrospective study of S. Korosec et al. [17], they analyze the outcome of pregnancy after the transfer of fresh

and frozen embryos. The authors provide evidence that pregnancies after fresh embryo transfer have a higher rate of developing placenta previa development and third-trimester bleeding. In our study, we found that women with a history of operative hysteroscopy are more likely to bleed before delivery.

We managed to prove that even a condition like endometriosis, which is so well known, can have an impact on placentation and increase the rate of PAS disorders. In the observational study of N. Conti et al., they exhibit an increased rate of antepartum bleeding and placental complication during the first pregnancy of women with endometriosis [14].

CONCLUSION:

Placenta praevia and placenta accrete spectrum disorders are complications of pregnancy that affect the well-being of the mother during pregnancy and maternal and neonatal morbidity and mortality. Despite the unknown etiology of abnormal placentation, we should make efforts for a better and earlier diagnosis of the condition. The increase in understanding of the evolution of gynecological diseases allows us to develop knowledge of their etiology and the ability to define new risk factors so we can build good prevention strategies and health systems. New prospective research should focus on defining the risk factors that have the greatest impact on increasing the incidence of placenta praevia and PAS. Recognizing a patient who is at risk of adverse maternal and neonatal outcomes can lead to better triage of the patients, transferring them to a tertiary care hospital where timely and adequate intervention can be done so that complications for both the mother and the neonate could be minimized.

Abbreviations:

PAS - placenta accrete spectrum
ART-assisted reproductive technology
MRI - magnetic resonance imaging
D&C - dilation and curettage
IVF - in vitro fertilisation
ICSI - intracytoplasmic sperm injection

REFERENCES:

1. Jauniaux E, Alfirevic Z, Bhide AG, Belfort MA, Burton GJ, Collins SL, et al. Placenta Praevia and Placenta Accreta: Diagnosis and Management: Green-top Guideline No. 27a. *BJOG*. 2019 Jan;126(1):e1-e48. [[PubMed](#)]
2. Silver RM, Fox KA, Barton JR, Abuhamad AZ, Simhan H, Huls CK, et al. Center of excellence for placenta accreta. *Am J Obstet Gynecol*. 2015 May;212(5):561-8. [[PubMed](#)]
3. Marr JP. Historical Background Of The Treatment Of Placenta Praevia. *Bulletin of the History of Medicine*. 1941 Mar;9(3):258–93. [[Internet](#)]
4. Senkoro EE, Mwanamsangu AH, Chuwa FS, Msuya SE, Mnali OP, Brown BG, et al. Frequency, Risk Factors, and Adverse Fetomaternal Outcomes of Placenta Previa in Northern Tanzania. *J Pregnancy*. 2017;2017:5936309. [[PubMed](#)]
5. Cresswell JA, Ronsmans C, Calvert C, Filippi V. Prevalence of placenta praevia by world region: a systematic review and meta-analysis. *Trop Med Int Health*. 2013 Jun;18(6):712-24. [[PubMed](#)]
6. Shevell T, Malone FD, Vidaver J, Porter TF, Luthy DA, Comstock CH, et al. Assisted reproductive technology and pregnancy outcome. *Obstet Gynecol*. 2005 Nov;106(5 Pt 1):1039-45. [[PubMed](#)]
7. Berlac JF, Hartwell D, Skovlund CW, Langhoff-Roos J, Lidegaard Ø. Endometriosis increases the risk of obstetrical and neonatal complications. *Acta Obstet Gynecol Scand*. 2017 Jun;96(6):751-760. [[PubMed](#)]
8. Faiz AS, Ananth CV. Etiology and risk factors for placenta previa: an overview and meta-analysis of observational studies. *J Matern Fetal Neonatal Med*. 2003 Mar;13(3):175-

90. [PubMed]
9. Weis MA, Harper LM, Roehl KA, Odibo AO, Cahill AG. Natural history of placenta previa in twins. *Obstet Gynecol.* 2012 Oct;120(4):753-8. [PubMed]
10. Karami M, Jenabi E, Fereidooni B. The association of placenta previa and assisted reproductive techniques: a meta-analysis. *J Matern Fetal Neonatal Med.* 2018 Jul;31(14):1940-1947. [PubMed]
11. Slavov S. Placenta accreta spectrum disorders in pregnancies following in vitro fertilization. *MOJ Women's Health.* 2021; 10(4):70-72. [Crossref]
12. Tsamantioti ES, Mahdy H. Endometriosis. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. 2022 Sep 6. [PubMed]
13. Bulletti C, Coccia ME, Battistoni S, Borini A. Endometriosis and infertility. *J Assist Reprod Genet.* 2010 Aug;27(8):441-7. [PubMed]
14. Conti N, Cevenini G, Vannuccini S, Orlandini C, Valensise H, Gervasi MT, et al. Women with endometriosis at first pregnancy have an increased risk of adverse obstetric outcome. *J Matern Fetal Neonatal Med.* 2015; 28(15):1795-8. [PubMed]
15. Matsuzaki S, Ueda Y, Nagase Y, Matsuzaki S, Kakuda M, Kakuda S, et al. Placenta Accreta Spectrum Disorder Complicated with Endometriosis: Systematic Review and Meta-Analysis. *Biomedicines.* 2022 Feb 6;10(2):390. [PubMed]
16. Romundstad LB, Romundstad PR, Sunde A, von Düring V, Skjaerven R, Vatten LJ. Increased risk of placenta previa in pregnancies following IVF/ICSI; a comparison of ART and non-ART pregnancies in the same mother. *Hum Reprod.* 2006 Sep;21(9):2353-8. [PubMed]
17. Korosec S, Ban Frangez H, Verdenik I, Kladnik U, Kotar V, Virant-Klun I, et al. Singleton pregnancy outcomes after in vitro fertilization with fresh or frozen-thawed embryo transfer and incidence of placenta praevia. *Biomed Res Int.* 2014;2014:431797. [PubMed]

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