Original Research Report

ANALYSIS OF RISK FACTORS ASSOCIATED WITH THE INCIDENCE OF PLACENTA ACCRETA AT AN INDONESIAN TERTIARY HOSPITAL

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ABSTRACT

The incidence of placenta accreta during pregnancy constitutes a serious problem in reproductive health. This complication has increased significantly over the last few decades, especially in developed countries where cesarean deliveries have also risen. Placenta accreta spectrum can cause very severe bleeding and potentially lead to other serious complications. The purpose of this study was to analyze the risk factors associated with the incidence of placenta accreta in women giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. This quantitative study used an analytical observational research design, specifically the case-control approach. The study sample was all mothers who gave birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, between 2019 and 2023. In addition to a univariate analysis, the data were subjected to bivariate analysis using a two-sample independent t-test or Mann-Whitney test for ordinal data and for nominal data using the Chi-square test as well as multivariate analysis using logistic regression ($p<0.05$). The results showed that parity, a history of cesarean section, body mass index, and interbirth interval were the variables identified as significantly associated with placenta accreta. According to the logistic regression analysis, parity, a history of cesarean section, and a history of curettage were identified as the primary determinants of placenta accreta incidence. The classification of parity was found to have the most significant relationship to the incidence of placenta accreta. This study concluded that parity classification, a history of cesarean section, body mass index, and interbirth interval are the significant risk factors contributing to the increased incidence of placenta accreta at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

Keywords: Reproductive health; pregnancy; maternal health; placenta accreta

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Highlights:
1. The increased incidence of placenta accreta is contributed significantly by parity classification, a history of cesarean section, body mass index, and interbirth interval.
2. The findings of this study can be used as an additional reference in determining the risk of placenta accreta in pregnant women, specifically as an input in screening and antenatal care programs for pregnant women to provide early detection and appropriate management.

INTRODUCTION

Placenta accreta incidence has shown a substantial increase globally in the last few decades. The incidence is particularly high in developed countries, where the rate of cesarean deliveries is also increasing. Placenta accreta is observed in around 0.9% of all pregnancies around the world. Moreover, the incidence of placenta accreta occurs at a rate of 3 per 1000 deliveries worldwide (Kong et al. 2017).

Dr. Soetomo General Academic Hospital is a tertiary referral hospital located in Surabaya, Indonesia. Within the period of January 2014 to October 2018, the hospital recorded 155 cases of suspected placenta accreta among 7,528 deliveries, representing 2.05% of the overall deliveries (Sulistyono 2021). The morbidity and mortality figures for placenta accreta were found to be quite significant. Out of the 155 placenta accreta cases at Dr. Soetomo General Academic Hospital, eight mortalities were recorded, accounting for 5.19% of the total cases (Sulistyono 2021).

Placenta accreta is a histopathological term defined in 1937 by (Irving & Herrtig 1937). Placenta accreta is histologically characterized by the abnormal attachment of the placenta, either in its whole or partially, to the uterine wall after delivery. In terms of histology, this condition arises from the complete or partial absence of the basal decidual layer and the incomplete formation of fibrinoid and nitabuch layers (Jauniaux et al. 2022).

Placenta accreta is a consequence of uterine remodeling after surgery, especially cesarean section. Cesarean section scars can result in the failure of normal decidualization and loss of the subdecidual myometrium. This transformation allows the villi that contain the placenta to undergo implantation. Moreover, the extravillous trophoblast cells migrate close to the surface of the uterine serosa (Jauniaux et al. 2022).

Placenta accreta spectrum can cause hefty bleeding and has the potential to result in other complications, such as coagulopathy, multi-organ failure, and death. In patients with placenta accreta spectrum, the average volume of blood loss is around 2–3 liters. These patients require a transfusion of 3.5–5.4 liters of red blood cells. Additionally, the patients may experience an injury to the bladder, occurring in approximately 7–48% of the total cases. As many as 15–66% of patients require treatment in the intensive care unit (ICU). The maternal mortality rate in patients with placenta accreta spectrum is around 1–7% (Damayanti et al. 2022). In light of the aforementioned background, it is necessary to analyze the risk factors related to the incidence of placenta accreta in mothers giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia.

MATERIALS AND METHODS

The type of research design used in this study was analytical observational with a case-control approach. We conducted a retrospective analysis of the incidence of placenta accreta in relation to its risk factors, tracing the affecting variables to assess the causes (Swarjana 2023). The sample in this study comprised all mothers who gave birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, from 2019 to 2023. Those who met the inclusion and exclusion criteria were selected as the research subjects. The sampling in this research was carried out using a non-probability sampling technique with a consecutive sampling approach.

The research subjects in this study amounted to 196 individuals who were divided into two groups: the case group and the control group. The case group consisted of 98 women who were diagnosed with placenta accreta, while the control group comprised women without a placenta accreta diagnosis. The data were subjected to statistical analysis using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, N.Y., USA).

The techniques used for the data analysis were univariate, bivariate, and multivariate. The bivariate analysis was performed using a two-sample independent t-test or Mann-Whitney test for ordinal data and for nominal data using the Chi-square test, whereas the multivariate analysis was carried out using logistic regression (Zhao et al. 2023). A statistical significance was indicated by a value of $p<0.05$. The independent variables analyzed were age, parity, diabetes mellitus, hypertension during pregnancy, a history of cesarean section, a history of curettage, endometriosis, body mass index (BMI), and interbirth interval. This research obtained ethical approval from the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, under reference No. 1360/LOE/301.4.2/VII/2023 dated 1/7/2023.

RESULTS

Table 1 displays the results of the statistical analysis. Parity, history of cesarean section, BMI, and interbirth interval demonstrated a significance value below 0.05. Consequently, these variables indicated a significant relationship with the incidence of placenta accreta in women giving birth at the Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The variables exhibiting a value beyond 0.05 were age, diabetes mellitus, hypertension during pregnancy, a history of curettage, and endometriosis.

The results of the logistic regression analysis can be seen in Table 2. It was found that parity, a history of cesarean section, and a history of curettage were the most common factors influencing the incidence of placenta accreta. Among the three variables exhibiting a significant relationship, parity was identified as having the most significant relationship

with the incidence of placenta accreta (p=0.000). Furthermore, the odds ratio for the parity variable was 28.262, indicating that mothers with a multiparity status were 28.262 times more likely to experience placenta accreta. The risk of placenta accreta increased with the number of pregnancies the women had experienced.

The statistical analysis revealed four variables that significantly increased the likelihood of placenta accreta incidence. The women giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, exhibited that parity, a history of cesarean section, BMI, and interbirth interval were significant risk factors for an incidence of placenta accreta. Figure 1 illustrates the distribution of the four significant risk factors.

Table 1. Results of the statistical analysis of independent variables.

Variables	Categories	Occurrence of placenta accreta				p	OR (95% CI)
		Present		Absent			
		n	%	n	%		
Age (y.o.)	≤35	56	57.1	57	58.2	0.885	1.043
	>35	42	42.9	41	41.8		
	Total	98	100	98	100		
Parity	Nulliparity	2	2.0	29	29.6	0.000	
	Low multiparity	86	87.8	69	70.4		
	Grand multiparity	10	10.2	0	0		
	Total	98	100	98	100		
Diabetes mellitus	No	80	81.6	78	79.6	0.718	0.878
	Yes	18	18.4	20	20.4		
	Total	98	100	98	100		
Hypertension during pregnancy	No	72	73.5	76	77.6	0.506	1.247
	Yes	26	26.5	22	22.4		
	Total	98	100	98	100		
History of cesarean section	≤1	22	22.4	59	60.2	0.000	5.226
	>1	76	77.6	39	39.8		
	Total	98	100	98	100		
History of curettage	No	65	66.3	76	77.6	0.080	1.754
	Yes	33	33.7	22	22.4		
	Total	98	100	98	100		
Endometriosis	No	78	79.6	75	76.5	0.605	0.836
	Yes	20	20.4	23	23.5		
	Total	98	100	98	100		
BMI	Underweight	1	1.0	2	2.0	0.001	
	Normal	7	7.1	23	23.5		
	Overweight	15	15.3	18	18.4		
	Obese	75	76.5	55	56.1		
	Total	98	100	98	100		
Interbirth interval (months)	≤18	26	26.5	48	49.0	0.002	
	19–58	39	39.8	29	29.6		
	≥59	33	33.7	21	21.4		
	Total	98	100	98	100		

Legends: OR=odds ratio; CI=confidence interval; y.o.=years old; BMI=body mass index.

Table 2. Results of the logistic regression analysis.

Variables	Slope	p	OR	95% CI for Exp(B)	
				Lower	Upper
Parity	3.342	0.000	28.262	5.390	148.196
History of cesarean section	1.726	0.000	5.620	2.407	13.120
History of curettage	1.322	0.006	3.752	1.466	9.598
Constant	-3.805	0.000	0.022		

Legends: OR=odds ratio; CI=confidence interval.

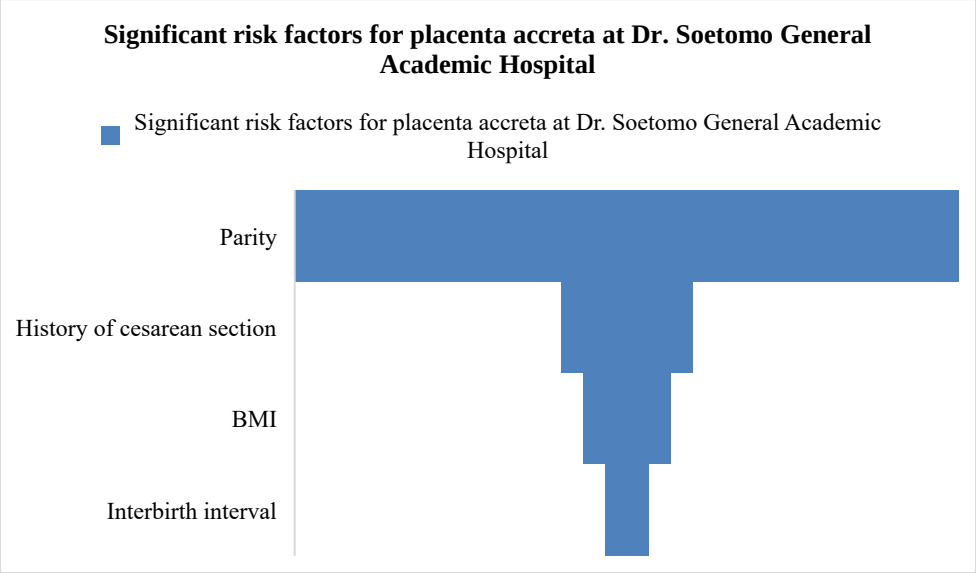

Figure 1. Chart illustrating the distribution of significant risk factors associated with the incidence of placenta accreta.

DISCUSSION

According to the analysis results, there was no significant relationship (p=0.885) between maternal age and the incidence of placenta accreta at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The results of this study are in line with the research conducted by Imafuku et al. (2021). The multivariate analysis in the study revealed that maternal age was not significantly related to the incidence of placenta accreta (p=0.2). The relationship between maternal age and the incidence of placenta accreta may be influenced by physical damage to the endometrial wall. A separate study also found a non-significant value (p=0.3), indicating no relationship between maternal age and the incidence of placenta accreta (Kyozuka et al. 2019).

In contrast to the findings of this study, other studies have identified a significant relationship between maternal age and the incidence of placenta accreta, such as those conducted by Qatrunnada et al. (2018) with p=0.009 and Ming et al. (2022) with p=0.001. The relationship between the two variables is attributed to the increased risk for placenta accreta incidence associated with advancing maternal age. As the maternal age increases, the proliferative activity intensifies, which leads the placenta to grow deeper into the myometrium and touch other organs, such as the bladder. Therefore, advanced-age pregnant women require close monitoring for the early detection of placenta accreta to reduce the risk of complications during labor (Miller et al. 1997). The Mann-Whitney statistical test conducted in this study yielded a result of p=0.000, indicating a significant relationship between parity and the incidence of placenta accreta in mothers giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Similarly, a previous study revealed a consistent finding, suggesting that multiparity was predominant in mothers experiencing placenta accreta (Ornaghi et al. 2021). Research conducted by Qatrunnada et al. (2018) at Dr. M. Djamil Central General Hospital, Padang, Indonesia, also found a significant relationship (p=0.01) between parity status and the incidence of placenta accreta. The study revealed that the incidence of placenta accreta was commonly identified in multiparous women. This might be attributed to fibrosis in the placental implantation scar from the previous pregnancy in mothers with multiparity. With every pregnancy and delivery, there will be a total or partial decrease in the decidua basalis, resulting in the villi attaching too profoundly to the myometrium (Bowman et al. 2013).

The results of this study differed from those of prior research conducted by Imafuku et al. (2021). According to the multivariate analysis results, the earlier study determined that parity has no significant effect on the incidence of placenta accreta (p=0.8). Another study was conducted by Li-Shu & Yan (2023) to identify the risk factors associated with placenta accreta. The study revealed no significant relationship between parity and the incidence of placenta accreta (p=0.12).

The Chi-squared test performed in this study yielded a result of p=0.718, indicating that there was no significant relationship between diabetes mellitus

and the incidence of placenta accreta in mothers giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The results of this study were in line with previous research conducted by Zhao et al. (2023). The research determined that diabetes mellitus did not significantly influence the incidence of placenta accreta (p=0.51).

Different from the findings of this study, Tadayon et al. (2022) demonstrated that there is a significant relationship between diabetes mellitus and the incidence of placenta accreta (p=0.04). The indirect relationship between diabetes and placenta accreta can be explained by the propensity of diabetes to increase pregnancy complications, including macrosomia, preeclampsia, hypertension, and cardiovascular complications. In addition, pregnant women with diabetes mellitus potentially experience a heightened frequency of obstetric interventions and cesarean sections as a result of uncontrolled blood glucose levels. These factors may exacerbate the condition of placenta accreta (Weissgerber & Mudd 2015).

In the Chi-squared test for the hypertension during pregnancy variable, a value of p=0.506 was obtained. The results indicated an absence of a significant relationship between hypertension during pregnancy and the incidence of placenta accreta in mothers giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The results of this study corresponded with those of prior research conducted by Tadayon et al. (2022). The previous study found no significant relationship between hypertension during pregnancy and the incidence of placenta accreta (p=0.51). Likewise, another study carried out by Mohammadi et al. (2022) also determined a significance value above 0.05 (p=0.82). This suggested that there was no relationship between hypertension during pregnancy and the incidence of placenta accreta.

The findings of this research were not in line with a study conducted by Matsuzaki et al. (2021), who found a significant relationship between hypertension during pregnancy and placenta accreta (p=0.001). Hypertension during pregnancy is associated with placenta accreta because it can cause damage to the blood vessels in the uterine wall, making it difficult for the placenta to attach properly to the uterus and thus may attach abnormally. This can make it difficult to remove the placenta after the baby is born and increases the risk of postpartum bleeding and infection (Li et al. 2022).

The Chi-square test for the cesarean section history variable produced a result of p=0.000. This demonstrated a significant relationship between a history of cesarian section and the incidence of placenta accreta in mothers giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Research conducted by Tadayon et al. (2022) revealed comparable findings, indicating a very significant relationship between a history of cesarean delivery and placenta accreta (p=0.001). These findings suggested that the most critical risk factor for placenta accreta is a previous cesarean section. Studies reported by El Gelany et al. (2019) and Shaamash et al. (2023) also revealed a significant relationship between a history of cesarean section and the incidence of placenta accreta, with significance values of p=0.00 and p=0.001, respectively. According to the research results, the risk of placenta accreta increases with elevated cesarean section rates.

A history of cesarean section is related to placenta accreta due to the formation of scar tissue from the surgery, which results in tissue hypoxia and prompts the trophoblast to invade deeper in search of adequate blood vessel supply. The placenta is generally attached to the muscle layer of the uterus, which contracts during the birth process and then separates naturally after the baby is born. However, in the case of cesarean delivery, the surgical scar on the uterine muscle layer may interfere with the average growth and release of the placenta. Consequently, the placenta may attach too tightly to the uterine wall or even grow into the deeper muscle layers of the uterus, resulting in placenta accreta (Jauniaux et al. 2019).

A significance value of p=0.080 was obtained from the Chi-square test for the curettage history variable. This indicated that there was no significant relationship between a history of curettage and the incidence of placenta accreta in women giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The results of this research align with prior studies conducted by Qatrunnada et al. (2018) and Rac et al. (2015), which reported significance values of p=0.114 and p=0.82, respectively. The non-significant relationship between the two variables might result from successful regeneration after the endometrial curettage procedure, with a decidual reaction preventing the formation of scar tissue in the endometrium. Furthermore, the endometrial lining may have reformed following a septotomy, as observed during the hysteroscopic visualization of the uterine cavity (Engelbrechtsen et al. 2015).

The findings of this research were contrary to those of Tadayon et al. (2022), who reported that there is a very significant relationship between a history of curettage and placenta accreta (p=0.001). A history of curettage was found to be associated with placenta accreta in women who had undergone a curettage procedure. As a result of the procedure, these women consequently have an increased risk of

developing placenta accreta on the uterine tissue during their future pregnancies. Curettage performed during a previous pregnancy may lead to the formation of scar tissue on the uterine wall, potentially resulting in abnormal attachment of the placenta and elevating the risk of placenta accreta in the subsequent pregnancies (Jauniaux et al. 2019).

Regarding the endometriosis variable, the Chi-square test produced a result of p=0.605. This result indicated no significant relationship between a history of curettage and the incidence of placenta accreta in mothers giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The results of this study were in line with research conducted by Kyozuka et al. (2019), who found that there is no significant relationship between endometriosis and the incidence of placenta accreta (p=0.084). The multivariate analysis also revealed no significant relationship between the two variables (p=0.52).

In contrast to the findings of this study, Carusi et al. (2023) reported that there is a significant relationship between endometriosis and the incidence of placenta accreta (p=0.01). Endometriosis may be associated with placenta accreta, as it involves the proliferation of endometrial tissue outside the uterus. As a result, inflammation may occur, leading to the formation of scar tissue within the pelvic cavity. These effects may impact placental implantation in subsequent pregnancies (Berlac et al. 2017).

The Mann-Whitney statistical test for the BMI variable generated a value of p=0.001, implying a significant relationship between BMI and the incidence of placenta accreta in mothers giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Matsuzaki et al. (2021) disclosed similar findings as this study. A significant relationship was identified between BMI and placenta accreta, especially among those with obesity (p<0.001). Research conducted by Farquhar et al. (2017) also indicated a very significant relationship between BMI and the incidence of placenta accreta (p<0.05). A high BMI in pregnant women can raise the risk of placenta accreta. This is because overweight or obesity has the potential to affect the growth and function of the placenta. An elevated BMI before and during cesarean section, along with gestational diabetes, may increase the risk of cesarean section scar formation, subsequently influencing the occurrence of placenta accreta (Antila-Långsjö et al. 2018). On the other hand, prior research conducted by Kyozuka et al. (2019) revealed different findings. A significance value of p=0.925 from the prior study demonstrated no significant relationship between BMI and the incidence of placenta accreta.

According to the results of the Mann-Whitney test, there was a significant relationship (p=0.005) between the interbirth interval variable and the incidence of placenta accreta in women giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The results of this study were in line with research conducted by McLaughlin et al. (2022) and Farquhar et al. (2017), which suggest that there is a very significant relationship between interbirth interval and the incidence of placenta accreta (p<0.001). It has been shown that the risk of placenta accreta in subsequent pregnancies is influenced by the interval between deliveries. A short interbirth interval, specifically less than 18 months, increases the risk of placenta accreta in subsequent pregnancies. The uterine wall is still in the healing stage when the interbirth interval is too short, complicating the proper attachment of the placenta to the uterus (McLaughlin et al. 2022, Jauniaux et al. 2022).

Therefore, women need to pay attention to the delivery time interval in previous pregnancies and give the uterus enough time to recover before becoming pregnant again. If placenta accreta occurs in the subsequent pregnancy, the doctor can plan delivery by cesarean section and take other precautions to reduce the risk of postpartum complications (Jauniaux et al. 2022).

Women need to pay attention to the interbirth interval and allow sufficient time for the uterus to recover before attempting another pregnancy. If placenta accreta occurs in the subsequent pregnancy, the doctor can plan a cesarean section and implement additional precautions to reduce the risk of postpartum complications (Jauniaux et al. 2019). Future research is anticipated to explore other risk factors related to the incidence of placenta accreta, such as placenta previa, smoking, and in vitro fertilization-embryo transfer (IVF-ET) pregnancy, while utilizing a larger sample size to enhance the representativeness of the findings. It is also recommended that future research use primary data for an in-depth analysis.

Strength and limitations

The limitation of this research is that it was conducted at a single center, the Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. The patients' demographics might differ from those of patients in other locations. Therefore, the generalization of the research findings is applicable solely to hospitals that are similar in type and service level. Nevertheless, the findings of this study may serve as an additional reference for assessing the risk of placenta accreta in pregnant women. This study provides an input for the screening and antenatal care of pregnant women, specifically to facilitate

early detection and appropriate management. It is anticipated that Dr. Soetomo General Academic Hospital will implement promotional and preventive efforts to educate the public regarding the incidence of placenta accreta and optimize screening for patients with heightened risk factors to prevent complications that may result in maternal mortality.

CONCLUSION

Parity, a history of cesarean section, body mass index, and interbirth interval are significant risk factors for placenta accreta in women giving birth at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Among these risk factors, parity is the most predominant determinant in the incidence of placenta accreta.

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Conflict of interest

None.

Ethical consideration

This study was conducted with the approval obtained from the Health Research Ethics Committee of Dr. Soetomo General Academic Hospital, Surabaya, Indonesia, with reference No. 1360/LOE/301.4.2/VII/2023 dated 1/7/2023.

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Author contribution

AGC contributed to the conceptualization and design as well as the data collection, analysis, and interpretation. WS participated in the drafting of the article, design, critical revision of the article for important intellectual content, and final approval of the article for publication. GH made critical revisions of the article for important intellectual content and approved the final article before publication.

REFERENCES

Antila-Långsjö RM, Mäenpää JU, Huhtala HS, et al (2018). Cesarean scar defect: A prospective study on risk factors. American Journal of Obstetrics and Gynecology 219**,** 458.e1-458.e8. doi: 10.1016/j.ajog.2018.09.004.

Berlac JF, Hartwell D, Skovlund CW, et al (2017). Endometriosis increases the risk of obstetrical and neonatal complications. Acta Obstetricia et Gynecologica Scandinavica 96**,** 751–760. doi: 10.1111/aogs.13111.

Bowman Z, Eller A, Bardsley T, et al (2013). Risk factors for placenta accreta: A large prospective cohort. American Journal of Perinatology 31**,** 799–804. doi: 10.1055/s-0033-1361833.

Carusi DA, Gopal D, Cabral HJ, et al. (2023). A risk factor profile for placenta accreta spectrum in pregnancies conceived with assisted reproductive technology. F&S Reports 4**,** 279–285. doi: 10.1016/j.xfre.2023.05.004.

Damayanti GV, Rachman IT, Trirahmanto A (2022). Outcome overview of placenta accreta spectrum patients undergoing conservative and non-conservative management at Dr. Sardjito General Hospital. Jurnal Kesehatan Reproduksi. doi: 10.22146/jkr.74838.

Engelbrechtsen L, Langhoff-Roos J, Kjer JJ, et al (2015). Placenta accreta: Adherent placenta due to a sherman syndrome. Clinical Case Reports 3**,** 175–178. doi: 10.1002/ccr3.194.

Farquhar CM, Li Z, Lensen S, et al (2017). Incidence, risk factors and perinatal outcomes for placenta accreta in Australia and New Zealand: A case–control study. BMJ Open 7**,** e017713. doi: 10.1136/bmjopen-2017-017713.

El Gelany S, Mosbeh MH, Ibrahim EM, et al (2019). Placenta Accreta Spectrum (PAS) disorders: Incidence, risk factors and outcomes of different management strategies in a tertiary referral hospital in Minia, Egypt: a prospective study. BMC Pregnancy and Childbirth 19**,** 313. doi: 10.1186/s12884-019-2466-5.

IBM Corp. 2017. IBM SPSS statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. Available at: https://www.ibm.com/support/pages/downloading-ibm-spss-statistics-25.

Imafuku H, Tanimura K, Shi Y, et al (2021). Clinical factors associated with a placenta accreta spectrum. Placenta 112**,** 180–184. doi: 10.1016/j.placenta.2021.08.001.

Irving FC, Herrtig AT (1937). A study of placenta acreta. Surgery Gynecology and Obstetrics 64**,** 178–200. Available at: https://sid.ir/paper/576120/en.

Jauniaux E, Alfirevic Z, Bhide A, et al (2019). Placenta praevia and placenta accreta: Diagnosis and management. BJOG: An International Journal of Obstetrics & Gynaecology. doi: 10.1111/1471-0528.15306.

Jauniaux E, Jurkovic D, Hussein AM, et al (2022). New insights into the etiopathology of placenta accreta spectrum. American Journal of Obstetrics and Gynecology 227**,** 384–391. doi: 10.1016/j.ajog.2022.02.038.

Kong X, Kong Y, Yan J, et al (2017). On opportunity for emergency cesarean hysterectomy

and pregnancy outcomes of patients with placenta accreta. Medicine (Baltimore) 96**,** e7930. doi: 10.1097/MD.0000000000007930.

Kyozuka H, Yamaguchi A, Suzuki D, et al (2019). Risk factors for placenta accreta spectrum: Findings from the Japan environment and Children's study. BMC Pregnancy and Childbirth 19**,** 447. doi: 10.1186/s12884-019-2608-9.

Li-Shu T, Yan H (2023). Establishment of decision tree prediction model for risk factors of placenta accreta spectrum disorders. Journal of Sichuan University (Medical Sciences) 54**,** 400–405. doi: 10.12182/20230260307.

Li L, Liu L, Xu Y (2022). Hypertension in pregnancy as a risk factor for placenta accreta spectrum: A systematic review incorporating a network meta-analysis. Archives of Gynecology and Obstetrics 307**,** 1323–1329. doi: 10.1007/s00404-022-06551-y.

Matsuzaki S, Mandelbaum RS, Sangara RN, et al (2021). Trends, characteristics, and outcomes of placenta accreta spectrum: A national study in the United States. American Journal of Obstetrics and Gynecology 225**,** 534.e1-534.e38. doi: 10.1016/j.ajog.2021.04.233.

McLaughlin HD, Benson AE, Scaglione MA, et al (2022). Association between short interpregnancy interval and placenta accreta spectrum. AJOG Global Reports 2**,** 100051. doi: 10.1016/j.xagr.2022.100051.

Miller DA, Chollet JA, Goodwin TM (1997). Clinical risk factors for placenta previa–placenta accreta. American Journal of Obstetrics and Gynecology 177**,** 210–214. doi: 10.1016/S0002-9378(97)70463-0.

Ming Y, Zeng X, Zheng T, et al (2022). Epidemiology of placenta accreta spectrum disorders in Chinese pregnant women: A multicenter hospital-based study. Placenta 126**,** 133–139. doi: 10.1016/j.placenta.2022.06.009.

Mohammadi A, Bouzari Z, Hajian-Tilaki K, et al. (2022). Role of scaling combination of risk factors in clinical and imaging findings during pregnancy in predicting placenta accreta spectrum. Caspian Journal of Internal Medicine 13**,** 10–15. doi: 10.22088/cjim.13.1.10.

Ornaghi S, Maraschini A, Donati S (2021). Characteristics and outcomes of pregnant women with placenta accreta spectrum in Italy: A prospective population-based cohort study ed. Petry CJ. PLoS One 16**,** e0252654. doi: 10.1371/journal.pone.0252654.

Qatrunnada A, Agung Antonius P, Yusrawati Y (2018). Risk factors and outcomes of maternal placenta accreta at Dr. M. Djamil Padang General Hospital. Indonesian Journal of Obstetrics & Gynecology Science 1**,** 97–102. doi: 10.24198/obgynia.v1n2.94.

Rac MWF, Dashe JS, Wells CE, et al (2015). Ultrasound predictors of placental invasion: The placenta accreta index. American Journal of Obstetrics and Gynecology 212**,** 343.e1-343.e7. doi: 10.1016/j.ajog.2014.10.022.

Shaamash AH, AlQasem MH, Al Ghamdi DS, et al (2023). Adjunctive MRI in the diagnosis of placenta accreta spectrum in major placenta previa: Incidence, risk factors, and maternal morbidity. Annals of Saudi Medicine 43**,** 219–226. doi: 10.5144/0256-4947.2023.219.

Sulistyono A (2021). Characteristics of mothers with placenta accreta at Dr. Soetomo Hospital, Surabaya, 2017-2019 (thesis). Universitas Airlangga. Available at: https://lib.unair.ac.id/wplib/.

Swarjana IK (2023). Health research methodology: Latest edition. Penerbit Andi, Yogyakarta. Available at: https://books.google.co.id/books/about/METODOLOGI_PENELITIAN_KESEHATAN.html?id=T7HJEAAAQBAJ&redir_esc=y.

Tadayon M, Javadifar N, Dastoorpoor M, et al (2022). Frequency, risk factors, and pregnancy outcomes in cases with placenta accreta spectrum disorder: A case-control study. Journal of Reproduction & Infertility. doi: 10.18502/jri.v23i4.10814.

Weissgerber TL, Mudd LM (2015). Preeclampsia and diabetes. Current Diabetes Reports 15**,** 9. doi: 10.1007/s11892-015-0579-4.

Zhao H, Li X, Yang S, et al (2023). Risk factors of emergency cesarean section in pregnant women with severe placenta accreta spectrum: A retrospective cohort study. Frontiers in Medicine. doi: 10.3389/fmed.2023.1195546.