

Risk Factors of Placenta Accreta Spectrum: a systematic review

Aisha Grayli Cahyani^a, Willy Sandhika^{b*}

^b willysand@fk.unair.ac.id

^aFaculty of Medicine, Universitas Airlangga, Surabaya 60132, Indonesia

^bDepartment of Anatomic Pathology, Faculty of Medicine Universitas Airlangga, Surabaya 60132, Indonesia

Abstract

Background: An abnormal attachment of placental villous tissue to the uterine wall is known as placenta accreta spectrum. Based on the depth of the villous tissue adhering to the uterine wall, the placenta accreta spectrum is separated into three categories: accreta, increta, and percreta. The number of cesarean deliveries rises in tandem with the occurrence of spectrum placenta accreta. **Method:** This is a systematic review research where researchers will review relevant articles using predetermined criteria. Using the keyword of risk factors for placenta accreta spectrum from 2012 to 2022, we searched on PubMed. Obtain the seven most pertinent articles from Iran, Japan, Indonesia, the United Kingdom, Egypt, Australia, and New Zealand. **Result and discussion:** Of the seven articles that we have reviewed, it shows that the most common risk factors for placenta accreta spectrum are age, parity, history of caesarean section, history of curettage, placenta previa and body mass index. **Conclusion:** Based on the results obtained, six risk factors were found to be most associated with the incidence of placenta accreta spectrum. These risk factors are age, parity, history of curettage, history of cesarean section, placenta previa, body mass index, and smoking.

Keywords: maternal health, maternal mortality, placenta accreta, pregnancy

1. Introduction

American obstetricians and pathologists were the first to define the word "placenta accreta" in the context of obstetrics and histopathology. An obstetric condition known as placenta accreta is caused by an inappropriate attachment of villous tissue to the uterine wall. Depending on how deeply the villous tissue penetrates the uterine myometrium, there are three different types of villous tissue attachments: accreta, increta, and percreta. In the former case, the villi are attached to the myometrium without interposing the decidua; in the latter case, the villi penetrate the myometrium and even the surrounding organs. [1]. One of the worst obstetrical situations is placenta accreta spectrum (PAS), which typically results in significant blood loss, significant morbidity, and even death [2]. The uterine scar, particularly the scar from a cesarean section, is the fundamental pathophysiology of placenta accreta. After a woman undergoes a cesarean section, the resistance of the blood vessels in the uterus increases, and circulation disorders in the area around the scar tissue cause obstruction of vascularization and reduced epithelialization. This scar area without extensive trophoblastic re-epithelialization invades the myometrium and beyond the decidua and will cause abnormal placental implantation. This occurrence of placenta accreta spectrum can increase morbidity and mortality in the mother and fetus if it is not detected early [3]. Abdominal and transvaginal ultrasound were used to diagnose placenta accreta spectrum, and ultrafast T2-weighted MRI (sagittal, coronal, and axial slices) was used to define the condition topographically [4]. An ultrasonography can diagnose placenta accreta and aid early detection [3]. The inability of placental detachment is the clinical result of aberrant placental attachment, which will cause postpartum bleeding, which will significantly increase maternal mortality and morbidity [5]. When placenta

accreta is discovered early, it can be done by ultrasound, MRI, or C.T. scan [6]. Based on observational studies conducted between 1970 and 1980, the frequency of placenta accreta increased significantly., especially in developed countries where cesarean delivery was also increasing [7]. The increase in the incidence of placenta accreta over the last 50 years has come from an increase in cesarean deliveries. One study stated that the average incidence of placenta accreta was 1 in 7,000 reported deliveries. Over the past ten years, the incidence of placenta accreta has been reported to have grown from 0.8 per 1,000 pregnancies in the 1980s to 3 per 1,000 deliveries. [8].

2. Method

This is a systematic review research where researchers will review relevant articles using predetermined criteria. Articles were obtained from searches via Pubmed with filter criteria for 2012-2022 articles. The inclusion criteria specified are full-text access in Indonesian or English, there is compatibility between research objectives and results, and it is primary research, not a literature review, systematic review, or meta-analysis. The keywords used in the article search were risk factors for placenta accreta spectrum.

3. Results

The first search found 204 articles, then filtered based on title, abstract, and keywords, and found 21 articles that were considered relevant to be re-screened. The second filtering was based on the content of the entire text and obtained the 7 most relevant articles for review.

Tabel 1. Risk Factors Placenta Accreta Spectrum

Number	Author	Research Title	Country	Year	Factors
1	Imafuku & Tanimura et al., 2021	Clinical factors associated with a placenta accreta spectrum	Jepang	2021	age, parity, history of cesarean section, history of hysteroscopy, history of myomectomy, history of UAE and placenta previa
2	Qathrunnada et al., 2018	Risk Factors and Outcomes of Maternal Placenta Accreta at Dr. M. Djamil Padang	Indonesia	2018	age, parity, history of cesarean section, placenta previa, history of curettage, and history of other uterine operations
3	Fitzpatrick et al., 2012	Incidence and Risk Factors for Placenta Accreta/Increta/Percreta in the U.K.: A National Case-Control Study	U.K.	2012	age, body mass index, smoking, parity, history of cesarean section, history of other uterine surgery, and placenta previa

4	El Gelany 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	Egypt	2019	Age, Parity, history of cesarean section
5	Kyozuka et al., 2019	Risk factors for placenta accreta spectrum: findings from the Japan Environment and Children's Study	Jepang	2019	placenta previa, smoking, history of cesarean section, uterine anomalies, endometriosis, adenomyosis, uterine myoma, maternal age
6	Farquhar et al., 2017	Incidence, risk factors and perinatal outcomes for placenta accreta in Australia and New Zealand: a case-control study	Australia and New Zealand	2017	maternal age, indigenous status, ethnicity, body mass index, smoking, parity, history of cesarean section, placenta previa, multiple pregnancy
7	Tadayon et al., 2022	Frequency, Risk Factors, and Pregnancy Outcomes in Cases with Placenta Accreta Spectrum Disorder: A Case-Control Study	Iran	2022	maternal age, gravidity, history of abortion, history of curettage, prior cesarean delivery, number of cesarean deliveries, myomectomy, infertility treatment, smoking, history of accreta, history of previa, multiple pregnancy hypertensive disorder, diabetes previa

5. Discussion

The occurrence of placenta accreta is correlated with Age because if a pregnant woman is > 35 years of age, she is at risk of experiencing placental dysfunction, and the higher the mother's Age, the uterus will experience degeneration, resulting in an abnormal placenta. At > 35 years of age, the condition of the endometrium has changed, namely vascular sclerosis blood, which will cause a decrease in vascularization and result in tissue hypoxia [9]. According to Bowman et al. (2013), maternal age contributes to the likelihood of an increase in cesarean sections and placenta previa, a separate cause of placenta accreta [10]. This is by research conducted by Imafuku et al. (2021) and Qathrunnada et al. (2018); they claimed a connection existed between placenta accreta occurrence and age. [9,11]. Likewise, research conducted by Fitzpatrick et al. (2012), Tadayon et al. (2022), Farhuhar et al. (2017), and Kyozyuka et al. (2019) found that age was related to the incidence of placenta accreta [12,13,14,15].

Parity has a significant relationship with increasing the risk of placenta accreta because the higher the parity of the mother, the higher the risk of experiencing complications in pregnancy. Because with each pregnancy, the performance of the basal decidua cells will decrease so that the villi can penetrate the myometrium or other organs [10]. Women aged > 35 years will also face a significant risk of experiencing medical problems during pregnancy, such as hypertension, diabetes, fetal growth problems, and placental problems [16]. This is to research conducted by Imafuku et al. (2021), El Gelany et al. (2019), and Qathrunnada et al. (2018), which stated that there was a relationship between parity and the incidence of placenta accreta [9,11,17]. Likewise, research conducted by Fitzpatrick et al. (2012), Tadayon et al. (2022), and Farhuhar et al. (2017) found that parity was associated with the incidence of placenta accreta [12, 13,14].

The action of curettage on the endometrium can cause injury to the uterus. Hence, the mechanism of placenta accreta in mothers with a previous history of curettage is that it can cause the failure of decidualization and cause abnormal inner placenta-holding villi and trophoblast infiltration in the scar area [11]. Women who have had tissue removed from the uterus have a higher risk of experiencing placenta accreta in subsequent pregnancies. Curettage performed in a previous pregnancy can cause scar tissue to form on the uterine wall and increase the risk of placenta accreta in subsequent pregnancies [18]. This is to research conducted by Imafuku et al. (2021), Fitzpatrick et al. (2012), and Tadayon et al. (2022); it asserts a connection between the prevalence of placenta accreta and a history of curettage. [11,12,13].

A history of cesarean section can also increase the risk of placenta accreta because cesarean section scars can leave scar tissue, which will result in the placenta adhering to the scar tissue too firmly. Given the high prevalence of the illness in women who have had prior cesarean deliveries and placenta praevia, it is possible to keep a close eye out for unusual placental invasion in this population of women and prepare them for delivery appropriately. [12]. Based on the pathology of placenta accreta, uterine damage caused by a cesarean section scar allows the placenta to grow through the absent or damaged nitabuch layer in the myometrium [10]. This is by research conducted by Imafuku et al. (2021), El Gelany et al. (2019), and Qathrunnada et al. (2018), research shown a connection between the prevalence of placenta and a history of cesarean sections. [9,11,17]. Likewise, research conducted by Fitzpatrick et al. (2012), Tadayon et al. (2022), Kyozyuka et al. (2019), and Farhuhar et al. (2017) discovered that placenta accreta incidence was correlated with a history of cesarean sections [12,13,14,15].

Placenta previa can cause placenta accreta because the placenta usually covers the scar. Because placenta previa and past cesarean deliveries are associated with a higher incidence of the disease, it is possible to maintain a high index of suspicion for aberrant placental invasion in this group of women and undertake the necessary delivery preparations. [12]. The mechanism of placenta previa, which can cause placenta accreta, is that placental implantation requires an environment rich in oxygen and collagen. Because the uterine scar provides a place rich in

oxygen and collagen, the trophoblast will stick to the scar, and if it is too deep, it will cause placenta accreta [19]. This is by research conducted by Imafuku et al. (2021), El Gelany et al. (2019), and Qathrunnada et al. (2018). It claimed that placenta previa and the frequency of placenta accreta were related [9,11,18]. Likewise, research conducted by Fitzpatrick et al. (2012), Tadayon et al. (2022), Kyozyuka et al. (2019), and Farquhar et al. (2017) discovered that placenta previa was connected to placenta occurrence [12,13,15,14].

Several studies show that women with a body mass index of more than 30 have a risk of placenta accreta that is around 2-3 times higher than women with a body mass index of less than 25. In addition, other studies also show that the higher the body mass index in early pregnancy, the higher the risk of placenta accreta. accreta in these pregnancies [12]. Obesity is associated with placenta accreta because, in obese patients, it can lead to an increased risk of infection and poor wound healing. In obese women, cesarean deliveries tend to require longer operating times and are linked to an increased risk of postpartum hemorrhage, endometritis, and venous thromboembolism [20]. Research conducted by Farquhar et al. (2017) discovered a correlation between body mass index and the prevalence of placenta accreta. [14].

Due to hypercoagulability and an increased risk of thrombosis, smoking can increase the risk of placenta accreta. Studies on women who have placenta accreta have shown hypercoagulability and hyperfibrinolysis. During physiological adaptation during pregnancy, the hemostatic system appears relatively hypercoagulable with decreased anticoagulation function. As a result, the exact mechanism behind the association between smoking and placenta accreta occurrence is unknown. Nonetheless, endometrial epithelium and myometrium destruction are among the genital tract's effects of systemic inflammation brought on by pollution. Exposure to pollutants during pregnancy causes endometrium inflammation, which leads to placenta accreta [21]. According to Bowman et al. (2013), smoking can interfere with wound healing and can cause placenta accreta [10]. Research conducted by Kyozyuka et al. (2019) and Farquhar et al. (2017) found that smoking was associated with the incidence of placenta accreta [14,15].

6. Conclusion

Based on the results, several risk factors were most associated with placenta accreta. These risk factors are age, parity, history of curettage, history of cesarean section, placenta previa, body mass index, and smoking.

References

- [1].Liu X, Wang Y, Wu Y, Zeng J, Yuan X, Tong C, et al. What we know about placenta accreta spectrum (PAS). *European Journal of Obstetrics & Gynecology and Reproductive Biology* [Internet]. 2021 Apr 1 [cited 2023 Oct 23];259:81–9. Available from: <https://www.sciencedirect.com/science/article/pii/S0301211521000701>
- [2].Aryananda RA, Nieto-Calvache AJ, Duvekot JJ, Aditiawarman A, Rijken MJ. Management of unexpected placenta accreta spectrum cases in resource-poor settings. *AJOG Global Reports*. 2023;3(2):100191. DOI: 10.1016/j.xagr.2023.100191
- [3].Palacios-Jaraquemada JM, Nieto-Calvache AJ, Aryananda RA, Basanta N, Campos CI, Ariani G. Placenta accreta spectrum with severe morbidity: fibrosis associated with cervical-trigonal invasion. *The Journal of Maternal-Fetal & Neonatal Medicine*. Taylor & Francis; 2023;36(1):2183741. DOI: 10.1080/14767058.2023.2183741
- [4].Pegu B, Thiagaraju C, Nayak D, Subbaiah M. Placenta accreta spectrum-a catastrophic situation in obstetrics. *Obstet Gynecol Sci* [Internet]. 2021 May [cited 2023 Nov 1];64(3):239–47. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8138076/>

- [5].Morlando M, Sarno L, Napolitano R, Capone A, Tessitore G, Maruotti GM, et al. Placenta accreta: incidence and risk factors in an area with a particularly high cesarean section rate. *Acta Obstetrica et Gynecologica Scandinavica* [Internet]. 2013 [cited 2023 Oct 23];92(4):457–60. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/aogs.12080>
- [6].Tinari S, Buca D, Cali G, Timor-Tritsch I, Palacios-Jaraquemada J, Rizzo G, et al. Risk factors, histopathology and diagnostic accuracy in posterior placenta accreta spectrum disorders: systematic review and meta-analysis. *Ultrasound in Obstetrics & Gynecology* [Internet]. 2021 [cited 2023 Oct 23];57(6):903–9. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1002/uog.22183>
- [7].Hecht JL, Baergen R, Ernst LM, Katzman PJ, Jacques SM, Jauniaux E, et al. Classification and reporting guidelines for the pathology diagnosis of placenta accreta spectrum (PAS) disorders: recommendations from an expert panel. *Modern Pathology* [Internet]. 2020 Dec 1 [cited 2023 Oct 23];33(12):2382–96. Available from: [https://www.modernpathology.org/article/S0893-3952\(22\)00411-2/fulltext](https://www.modernpathology.org/article/S0893-3952(22)00411-2/fulltext)
- [8].Purwoko P, Rusman R, Aditya MR. Serial Kasus: Manajemen Anestesi pada Wanita Hamil dengan Plasenta Akreta yang Direncanakan Tindakan Seksio Sesarea. *JAOI* [Internet]. 2020 May 12 [cited 2023 Feb 22];3(1):26–34. Available from: <https://www.jurnalanestesiobstetri-indonesia.id/ojs/index.php/Obstetri/article/view/v3i1.40>
- [9].Qatrunnada A, Agung Antonius P, Yusrawati Y. Faktor Risiko dan Luaran Maternal Plasenta Akreta di RSUD Dr. M. Djamil Padang. *Obgynia* [Internet]. 2018 Sep [cited 2023 Oct 10];1(2):97–102. Available from: <https://www.obgynia.com/obgyn/index.php/obgynia/article/view/94>
- [10].Bowman Z, Eller A, Bardsley T, Greene T, Varner M, Silver R. Risk Factors for Placenta Accreta: A Large Prospective Cohort. *Amer J Perinatol* [Internet]. 2013 Dec 12 [cited 2023 Oct 13];31(09):799–804. Available from: <http://www.thieme-connect.de/DOI/DOI?10.1055/s-0033-1361833>
- [11].Imafuku H, Tanimura K, Shi Y, Uchida A, Deguchi M, Terai Y. Clinical factors associated with a placenta accreta spectrum. *Placenta* [Internet]. 2021 Sep 1 [cited 2023 Oct 23];112:180–4. Available from: <https://www.sciencedirect.com/science/article/pii/S0143400421004999>
- [12].Fitzpatrick KE, Sellers S, Spark P, Kurinczuk JJ, Brocklehurst P, Knight M. Incidence and Risk Factors for Placenta Accreta/Increta/Percreta in the UK: A National Case-Control Study. *PLoS One* [Internet]. 2012 Dec 27 [cited 2023 Oct 14];7(12):e52893. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3531337/>
- [13].Tadayon M, Javadifar N, Dastoorpoor M, Shahbazian N. Frequency, Risk Factors, and Pregnancy Outcomes in Cases with Placenta Accreta Spectrum Disorder: A Case-Control Study. *JRI* [Internet]. 2022 Oct 11 [cited 2023 Oct 14]; Available from: <https://publish.kne-publishing.com/index.php/JRI/article/view/10814>
- [14].Farquhar CM, Li Z, Lensen S, McLintock C, Pollock W, Peek MJ, et al. Incidence, risk factors and perinatal outcomes for placenta accreta in Australia and New Zealand: a case-control study. *BMJ Open* [Internet]. 2017 Oct 5 [cited 2023 Oct 14];7(10):e017713. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5640005/>
- [15].Kyojuka H, Yamaguchi A, Suzuki D, Fujimori K, Hosoya M, Yasumura S, et al. Risk factors for placenta accreta spectrum: the Japan Environment and Children's study findings. *BMC Pregnancy Childbirth* [Internet]. 2019 Dec [cited 2023 Oct 10];19(1):447. Available from: <https://bmcpregnancychildbirth.biomedcentral.com/articles/10.1186/s12884-019-2608-9>
- [16].Nurzia N. Hubungan Usia Dan Paritas Ibu Dengan Kejadian Plasenta Previa Di Ruang Kebidanan RSUD Raden Mattaher Provinsi Jambi Tahun 2015. 2015;4(04).
- [17].El Gelany S, Mosbeh MH, Ibrahim EM, Mohammed M, Khalifa EM, Abdelhakium AK, et al. 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 Childbirth [Internet]. 2019 Aug 27 [cited 2023 Oct 14];19:313. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6712589/>
- [18].Jauniaux E, Hussein AM, Fox KA, Collins SL. New evidence-based diagnostic and management strategies for placenta accreta spectrum disorders. *Best Practice & Research Clinical Obstetrics & Gynaecology* [Internet]. 2019 Nov [cited 2023 Feb 16];61:75–88. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1521693419300422>
- [19].Anderson-Bagga FM, Sze A. Placenta Previa. In: *StatPearls* [Internet]. Treasure Island (F.L.): StatPearls Publishing; 2023 [cited 2023 Nov 2]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK539818/>
- [20].Vieira MC, Rijken MJ, Braun T, Chantraine F, Morel O, Schwickert A, et al. The relation between maternal obesity and placenta accreta spectrum: A multinational database study. *Acta Obstetricia et Gynecologica Scandinavica* [Internet]. 2021 [cited 2023 Nov 2];100(S1):50–7. Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/aogs.14075>
- [21].Jenabi E, Salehi AM, Masoumi SZ, Maleki A. Maternal Smoking and the Risk of Placenta Accreta Spectrum: A Systematic Review and Meta-Analysis. *Biomed Res Int* [Internet]. 2022 Jul 11 [cited 2023 Nov 1];2022:2399888. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9293521/>