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MATERNAL OUTCOMES IN DELIVERIES WITH PLACENTA ACCRETA SPECTRUM: A SYSTEMATIC REVIEW

Rizki Selly Apriliani*, Suryane Sulistiana Susanti, Wiwit Kurniawati, Imami Nur Rachmawati
Faculty of Nursing, Universitas Indonesia, Jl. Prof. DR. Sudjono D. Pusponegoro, Pondok Cina, Beji, Depok, West Java 16424, Indonesia
*rizki.selly@ui.ac.id

ABSTRACT
Postpartum hemorrhage is a leading complication, causing approximately 75% of maternal deaths. Placenta accreta spectrum (PAS) is characterized by the abnormal invasion of placental trophoblasts into the uterine myometrium, increasing the risk of severe hemorrhage. Globally, PAS incidence has risen, ranging from 0.2% to 0.9% of all pregnancies, primarily due to the increasing number of cesarean deliveries. Other maternal outcomes can also occur in mothers with PAS cases. Objective: this systematic review aims to describe maternal outcomes in deliveries involving PAS. Method: this systematic review study uses the PRISMA guidelines for literature search through databases, including ScienceDirect, ProQuest, Wiley, and Taylor and Francis, focusing on cohort and case-control studies. Thirteen articles in English published between 2019–2024 were analyzed, with 2,455 for total samples. Results: the study identified maternal outcomes, including hemorrhage, organ injury, infections, thromboembolism, vesicovaginal fistula, intensive care admission, and maternal death, with hemorrhage being the most significant complication. Recommendation: Optimal PAS management requires a combination of technology-based strategies, multidisciplinary collaboration, and well-planned interventions to reduce maternal morbidity and mortality.

Keywords: labor complications; maternal outcome; peripartum women; placenta accreta; placenta diseases

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INTRODUCTION

According to WHO (2024), around 287,000 women died during and after pregnancy and childbirth in 2020. The main complications that cause almost 75% of all maternal deaths, one of which is due to severe bleeding and most bleeding occurs after delivery. In normal pregnancy, the placenta will attach to the deciduous endometrium. Abnormal invasion of placental trophoblasts into the uterine myometrium is called placenta accreta, this is a clinical condition in which the placenta grows too deep in the uterus and is a potentially life-threatening condition due to the increased possibility of severe postpartum hemorrhage. Based on the level of myometrial invasion, spectrum disorders are divided into placenta accreta, placenta increta, and placenta percreta (Shepherd & Mahdy, 2022; Tantbirojn et al., 2008).

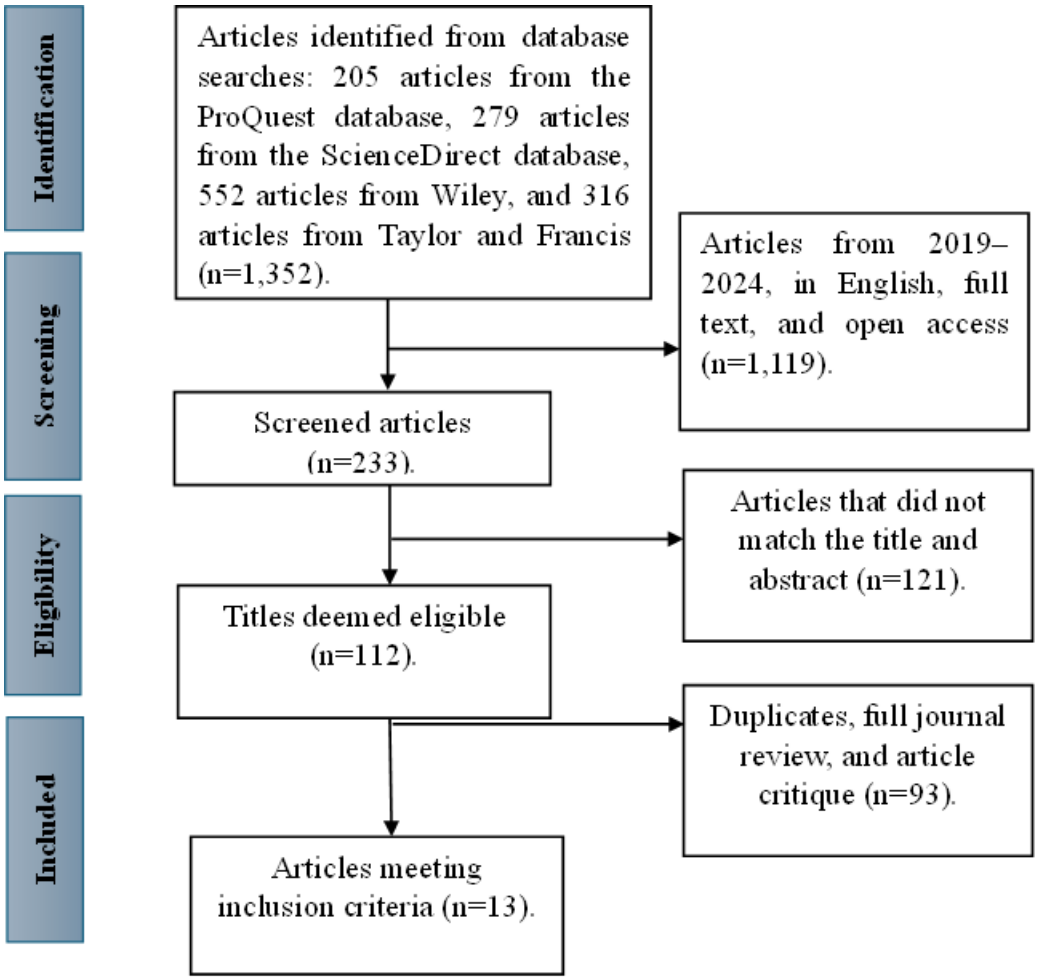
Risk factors for placenta accreta include a history of previous cesarean section, a history of previous uterine surgery, and advanced maternal age (Noël et al., 2024). In a study (Kiliçci et al., 2017) it was stated that women with a history of cesarean section had a 9.74-fold risk of developing placenta accreta. The incidence of placenta accreta has increased from 1 in 30,000 pregnancies in the 1960s to 1 in 533 pregnancies in the 2000s. A study stated that the current incidence is 1 in 272 (Shepherd & Mahdy, 2022). As previously mentioned, a history of previous cesarean sections is a risk factor for placenta accreta, so the increase in the incidence of placenta accreta over the past few decades reflects the increase in cesarean deliveries.Placenta accreta cases have increased significantly globally in recent decades with

the incidence of placenta accreta estimated to range from 0.2% to 0.9% of all pregnancies. This is mainly due to the increasing number of cesarean deliveries. Some studies have reported higher incidences in certain regions, such as 0.91% in a referral hospital in Egypt (Sharami et al., 2024a; Zhao et al., 2024).

Placenta accreta can be diagnosed prenatally using ultrasound and MRI, but is often not recognized until excessive bleeding occurs after delivery. Hysterectomy may be indicated for all three types of placental adhesions if bleeding is uncontrolled (Lowdermilk et al., 2016 ; Bauer & Bonanno, 2009). Therefore, the common management strategy adopted in mothers with placenta accreta is to proceed with planned delivery at 34 weeks of gestation with the aim of reducing the risk of bleeding (Cahill et al., 2018). There have been many studies reporting maternal outcomes from placenta accreta spectrum events, which are not only bleeding that occurs during delivery, there are other impacts or other maternal outcomes from childbirth with placenta accreta. Therefore, this literature review study was conducted to describe maternal outcomes which can occur during labor in mothers with placenta accreta. The objective of this study is to describe various maternal outcomes in deliveries involving Placenta Accreta Spectrum (PAS). By conducting a systematic review of recent studies, this research aims to identify maternal complications associated with PAS, including hemorrhage, organ injury, infections, thromboembolism, vesicovaginal fistula, intensive care admission, and maternal mortality. The findings of this study are expected to provide deeper insights into the impact of PAS on maternal health and support the development of optimal management strategies to reduce maternal morbidity and mortality.

METHOD

The method used in this research is a systematic review, which is an approach used to identify and combine all available research related to a particular topic, so that it becomes an effective method for achieving the stated research objectives. LaporanThis systematic review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines . The first step in the review process is to formulate POE (Problem, Exposure, and Outcomes) questions, namely "how are maternal outcomes that can occur in mothers giving birth with placenta accreta?". The next step is to search for literature. The journals used in this study are articles with keywords, namely " peripartum women and (placenta accreta not placenta previa) and (maternal outcome or labor complications)"; "(pregnant women or peripartum women) and placenta accreta and maternal outcomes"; "peripartum women and (placenta accreta not placenta previa) and maternal outcome". With journal qualifications in the last five years from 2019-2024, in English and Indonesian, full text research article journal type and open access. Search for academic journals through electronic databases, namely ScienceDirect, ProQuest, Wiley, and Taylor and Francis, where journals were accessed between December 2 and December 9, 2024. Inclusion criteria in the literature search, namely articles with studies that produce maternal outcomes in mothers giving birth with placenta accreta spectrum. Articles that also include mothers with a combined diagnosis of placenta previa are not included in the review. The types of research reviewed are research with cohort, case report, and cross-sectional methods. The next stage is to conduct a critical appraisal for cohort and case report research using the JBI form.



RESULT

Table 1
Article Search Results Table Summary

No	Author, Year of Publication, Title, and Country	Objective	Design	Sample / Sampling Technique	Results
1	Aryananda et al. (2023) *Management of unexpected placenta accreta spectrum cases in resource-poor settings* Colombia and Indonesia	Describe maternal outcomes of previously undiagnosed cases of placenta accreta spectrum (SPA) managed in low-resource hospitals in Colombia and Indonesia, and evaluate the impact of using telemedicine to aid intraoperative management of unanticipated SPA.	Retrospective descriptive cohort	• The total analyzed was 29 cases with SPA. • The sampling technique used is sequential case sampling. • The sample was divided into two groups, namely the group that received telehelp (n=22) and the group that did not receive telehelp (n=5).	• Maternal deaths; of 29 women, 5 women (22.7%) were from the group that did not receive telehelp. There were no maternal deaths in the other groups. • Intraoperative bleeding; the use of telemedicine showed results with an average bleeding volume of 1250 mL compared to 2000 mL in cases without telemedicine. • Bladder injury occurred in 6 (27.3%) cases without telemedicine and 1 (14.3%) case with telemedicine. • ICU admission more than 24 hours was required in 17 (77.3%) cases without telemedicine, compared to only 6 (85.7%) cases with

No	Author, Year of Publication, Title, and Country	Objective	Design	Sample / Sampling Technique	Results
					telemedicine. ● Intra-abdominal abscess occurred in 3 cases (13.6%) in the non-telehelp group.
2	(Sentilhes et al., 2022) *Conservative management or cesarean hysterectomy for placenta accreta spectrum: the PACCRETA prospective study* English	To compare severe maternal outcomes between women with PAS treated with cesarean hysterectomy and conservative management (placenta in situ)	Observational cohort retrospective	● The total sample was 148 women with PAS disorders ● 86 underwent conservative management ● 62 underwent hysterectomy. ● Non-randomized sampling techniques	● Bleeding > 3000 ml: In the conservative management group, there were 9 (10.7%), compared to 27 (45.8%) in the hysterectomy group with RR 0.27 ($p < 0.001$) ● Arterial embolization: In the conservative management group, 21 (24.4%) women, compared to 2 (3.2%) women in the hysterectomy group. Conservative management resulted in significantly more arterial embolization (RR 12.07; $p < 0.001$). ● Endometritis (uterine infection): In the conservative management group, there were 9 (10.8%), compared to 0 cases in the hysterectomy group. The risk of endometritis was higher in conservative management ($p = 0.02$)
3	(Barinov & Di Renzo, 2024) *A new technique to preserve the uterus in patients with placenta accreta spectrum disorders* Austria	To evaluate the outcomes of a new technique in preserving the uterus in patients with SPA using a combined approach, compared with previous surgical techniques.	Retrospective cohort	● The total sample consisted of 147 women with SPA. ● 95 women in the intervention group received the combined technique ● 52 women in the control group who underwent previous surgical techniques. ● Samples were taken using *purposive sampling technique.*	● Bladder Injury: Bladder injury occurred in 2 patients (2.1%) in the study group and 20 patients (38.5%) in the control group (P=0.012). ● Blood Loss Volume: The mean blood loss volume was 1300 mL (interquartile range 900–2950 mL) in the study group, whereas it was 2000 mL (interquartile range 1800–4000 mL) in the control group (P=0.001).
4	(Simonetti et al., 2023) *Placenta Accreta Spectrum Disorders: How*	Describes the possibility of reducing blood transfusion in extraperitoneal	Retrospective cohort	● The sample consisted of 30 women with SPA who underwent	● Blood Loss: The mean blood loss in the classical hysterectomy group was higher (2902.8 ± 1324.7 mL) than in the extraperitoneal

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	to reduce maternal transfusion? A center experience on extraperitoneal retrograde hysterectomy Italy	retrograde hysterectomy surgery compared to classic postpartum hysterectomy in SPA patients.		hysterectomy. ● 18 women in the group received classical hysterectomy. ● 12 women in the group underwent retrograde extraperitoneal hysterectomy technique. ● Samples were taken using *purposive sampling technique.*	group (2166.7 ± 1316.6 mL), but this difference was not statistically significant. Bleeding volumes above 3000 mL were more common in the classical group (8 patients (44.4%) than in the extraperitoneal group (2 patients (16.7%), although still not significant. ● Ureteral (urinary tract) injury in 1 patient (5.6%) in the classic hysterectomy group ● Abdominal cavity bleeding occurred in 2 patients (11.1%) in the classical hysterectomy group, and 1 patient (8.3%) in the extraperitoneal group.
5	(Morlando et al., 2021) *Maternal and neonatal outcomes in planned versus emergency cesarean delivery for placenta accreta spectrum: A multinational database study* German	To compare maternal and neonatal outcomes in planned and emergency cesarean deliveries for SPA disorders and examine factors predicting the risk of emergency delivery.	Database-based multinational cohort	● The sample consisted of 356 women with SPA. ● 239 women underwent planned cesarean delivery ● 117 women underwent emergency delivery	● Bleeding: The median estimated blood loss in planned deliveries was 2000 ml (interquartile range [IQR] 1200–4000), while in emergency deliveries it was 1550 ml (IQR 1000–3500). There was no significant difference with p value = 0.89 ● ICU stay: higher in the emergency delivery group 53 patients (45%) compared to the planned delivery group 78 patients (33%) with P = 0.02 ● Renal Failure: 1 patient (1%) in emergency delivery, no cases in planned delivery (p = 0.33). ● Lower Urinary Tract Injury: 8 patients (7%) in emergency delivery and 10 patients (4%) in planned delivery (p = 0.31). ● Hemorrhagic Shock: 1 patient in both groups (p = 0.55).
6	(McCall et al., 2022) *Placenta accreta spectrum: Variations in clinical practice and maternal*	Comparing management practices and maternal outcomes in women with SPA spectrum in the	Population-based cohorts in two countries	● Sample of 353 women with SPA ● 219 women in France ● 134 women in	● Bleeding: median in the UK was 3050 mL (interquartile range 1700–6500 mL), whereas in France it was only 1000 mL (interquartile range 500–2500 mL). - Perempuan di Inggris lebih

No	Author, Year of Publication, Title, and Country	Objective	Design	Sample / Sampling Technique	Results
	morbidity between the UK and France: a population-based comparative study English and French	UK and France		England ● Purposive sampling technique	sering mengalami perdarahan postpartum berat (≥3000 mL) dengan proporsi 58% (77 perempuan) dibandingkan dengan 21% (43 perempuan) di Prancis (p< 0,001). - Kejadian perdarahan mayor (≥2000 mL), di Inggris 72,4% (97 perempuan), sedangkan di Prancis 31,1% (65 perempuan), dengan p<0.001 ● Pelvic artery embolization: more common in the UK (24.6% (33 women) than in France (22.4% (49 women), p = 0.627 ● Organ damage (bowel, urinary tract): in the UK it occurred in 7.5% (10 women) and in France 7.9% (17 women), with p = 0.889 ● Postpartum infection: occurred in 2.2% (3 women) in the UK and 1.4% (3 women) in France, with p = 0.332 ● Intensive Care Unit (ICU): 68.7% (92 women) of cases in the UK required admission to *the Intensive Therapy Unit* (ICU) compared to 30% (65 women) in France, with p < 0.001. ● Maternal death occurred 1 case in France
7	(Hanulikova et al., 2024) *Emergency delivery in case of suspected placenta accreta spectrum: Can it be predicted?* Finland	To identify independent risk factors that can predict the occurrence of emergency delivery in patients with suspected APS and to evaluate whether emergency delivery is associated with a risk of adverse maternal outcomes compared with	Retrospective cohort	● Sample of 182 SPA cases ● 93 patients underwent scheduled delivery ● 89 patients underwent emergency delivery ● Sampling technique with *purposive sampling*	● Bleeding: The mean blood loss in all patients was 2000 ml with an interquartile range (IQR) of 1421–3242 ml. The mean blood loss in patients with scheduled delivery was 2000 ml (IQR 1400–3000 ml), while in patients with emergency delivery it was 2000 ml (IQR 1485–3500 ml), with p = 0.46. ● Special room (ICU) A total of 50.8% or 92 patients in total were treated in the ICU.

No	Author, Year of Publication, Title, and Country	Objective	Design	Sample / Sampling Technique	Results
		scheduled delivery.			In the scheduled delivery group, 44.1% (41 patients) required ICU care, while in the emergency delivery group, 58.0% (51 patients), with p = 0.09 ● Urinary Tract Damage: Occurred in 18.3% (17 patients) of the scheduled group and 18.0% (16 patients) of the emergency group, with p = 1.0 ● Vesicovaginal fistula occurred in 3.2% (3 patients) of the scheduled group and in 1.1% (1 patient) of the emergency group (p=0.65) ● Thrombosis events occurred in 1.1% (1 patient) of the scheduled group and 3.4% (3 patients) of the emergency group (p=0.58) ● Maternal death occurred in 1.1% (1 patient) of the emergency group and none in the scheduled group, (p=0.98)
8	(Paping et al., 2024) *Opportunities for, and barriers to, uterus-preserving surgical techniques for placenta accreta spectrum* German	Exploring opportunities and barriers in implementing uterine-preserving surgical techniques in cases of SPA.	Prospective observational cohort	● The research sample consisted of 234 cases. ● 186 patients who underwent hysterectomy ● 38 patients were treated with focal resection ● 10 patients with placenta left in situ ● Purposive sampling technique	● Bleeding: The mean blood loss in the hysterectomy group was 2000 mL (IQR 1400–3000 mL), while in the focal resection group it was 1500 mL (IQR 1000–2500 mL) and leaving the placenta in situ was lower at 1600 mL (IQR 900–2800 mL), with p = 0.04. ● ICU care: A total of 40.9% of patients (76 patients) with hysterectomy were treated in the ICU, compared with 52.6% (20 patients) in the focal resection group and 10.0% (1 patient) in the leaving the placenta in situ group (p = 0.05) ● Urinary Tract or Bladder Injury: Occurred in 21.0% (39) of hysterectomy patients, 2.6% (1 patient) in the focal resection group, and (1 patient) 10.0% in the leave placenta in situ group ● Vesicovaginal Fistula: Hysterectomy: Occurred in 3

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					patients (1.6%). Leaving Placenta In Situ: Occurred in 1 patient (10.0%)
9	(Zhao et al., 2024) *Incidence, risk factors, and maternal outcomes of unsuspected placenta accreta spectrum disorders: a retrospective cohort study* China	To identify the incidence and risk factors of unsuspected SPA, and to compare maternal outcomes between suspected and unsuspected SPA cases at three large academic referral centers.	Retrospective cohort	• Total sample size 339 SPA cases • 120 are undetected SPA cases • 219 SPA cases detected • Samples were taken according to the criteria	• Bleeding: The suspected PAS group experienced blood loss of 1000 mL (IQR 800–2000 mL) in 24 hours postpartum, while in the undetected group the average was 2000 mL (IQR 1400–2400 mL), with $p < 0.001$. • ICU: 60 patients (27.4%) in the PAS detected group, 27 patients (22.5%) in the undetected group, with $p = 0.324$ • Bladder injury: 12 patients (5.5%) in the PAS detected group, 2 patients (1.7%) in the undetected group • Vascular injury: 2 patients (0.96%) in the PAS detected group, 0 patients in the undetected group
10	(McCall et al., 2024) *Obstetric and haematological management and outcomes of women with placenta accreta spectrum by planned or urgent delivery: Secondary data analysis of a public referral hospital in Lebanon* Lebanon	To compare maternal characteristics, management, and outcomes in women with SPA undergoing planned and emergency delivery at a major referral hospital in Lebanon.	Prospective cohort	• The sample consisted of 159 pregnant women who had been confirmed to have SPA. • Sampling technique according to inclusion criteria	• Bleeding Occurred in 66 patients (41.5%) of the total, with 42 patients (39.2%) in planned deliveries and 24 patients (46.1%) in emergency deliveries. The mean blood loss for emergency deliveries was 1500 ml (interquartile range 1200-2000 ml), which was higher than planned deliveries with a mean blood loss of 1200 ml (range 800-2000 ml), a statistically significant difference ($p = 0.011$) • ICU: A total of 10 patients (6.3%) required ICU care, with 5 patients (4.7%) from the planned group and 5 patients (9.6%) from the emergency group. The median length of stay in the ICU was 2.5 days (interquartile range: 1–4.5 days) • Injuries to organs such as the bladder or intestine were reported in 51 patients

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					(32.1%), consisting of 33 patients (30.8%) in the planned delivery group and 18 patients (34.6%) in the emergency group. ● Genitourinary fistula: occurred in 1 patient (0.9%) in the planned group, 1 patient (1.9%) in the emergency group, with p=0.549 ● Uterine rupture: only occurred in 1 patient in the emergency group (1.9%), with p = 0.327 ● Surgical wound infection: only in the emergency group, 2 patients (3.9%) ● Thrombosis: occurred in 1 patient (0.9%) in the planned group, 1 patient (1.9%) in the emergency group, with p=0.549
11	(Kyozuka et al., 2023) *Prophylactic resuscitative endovascular balloon occlusion of the aorta use during cesarean hysterectomy for placenta accreta spectrum: a retrospective cohort study* Japan	To evaluate the effectiveness of using resuscitative endovascular balloon occlusion of the aorta (REBOA) as a prophylactic measure to control bleeding during cesarean hysterectomy in patients with SPA.	Retrospective cohort	● The study sample consisted of 37 patients with a diagnosis of SPA who underwent cesarean hysterectomy. ● 13 patients underwent REBOA procedure ● 24 patients not with REBOA	● Bleeding: With REBOA: Median 1110 ml (interquartile range 669–2425 ml), without REBOA: Median 2160 ml (interquartile range 1510–3700 ml), with p: <0.05
12	(Yao et al., 2023) *Regional multidisciplinary team approach to the management of placenta accreta spectrum disorder* United States of America	Evaluating the impact of a multidisciplinary team in improving patient referral volume and clinical outcomes for patients with PAS at a tertiary referral center in California.	Retrospective cohort	● Total sample of 114 patients undergoing cesarean hysterectomy ● 59 in the control group where patients received routine care ● 55 patients in the intervention group managed by a multidisciplinary team.	● Bleeding: Without multidisciplinary team 2000 mL [IQR 1300 - 4000], with team 1500 mL [IQR 1000 - 2500], with p = 0.005 Jumlah pasien dengan perdarahan ≥ 2000 mL : tanpa tim 34 (57.6%), dengan tim 21 (38.2%), p = 0.04 ● ICU care: without team 27.1%, with team 12.7%, p=0.06 ● Bladder injury: without team 12.7%, with team 16.4%, p

No	Author, Year of Publication, Title, and Country	Objective	Design	Sample / Sampling Technique	Results
				● Samples were taken using *purposive sampling technique* .	= 0.33
13	(Sharami et al., 2024) *Placenta accreta outcomes and risk factors in a referral hospital in north of Iran: A case control study* Iran	To analyze the main risk factors and maternal and neonatal outcomes of SPA syndrome in pregnant women hospitalized in a referral hospital in Northern Iran.	*Case control*	● The total sample consisted of 267 pregnant women who had a history of delivery by cesarean section. ● 89 women in the case group (with SPA ● 178 women were in the control group (no SPA) ● The sample was selected using the *convenient sampling method.*	● Bleeding: The mean in the group with PAS was 2544 mL, while in the group without PAS it was 1750 mL, significantly higher than the control group (P < 0.001). ● Specialized hospitalization (ICU): All women in the PAS group required ICU care, compared with 11 patients (6.17%) in the control group (P < 0.001)

Study Identification and Selection

The initial literature search results in several databases identified a total of 1,352 articles, consisting of 205 articles from Proquest, 279 from ScienceDirect, 552 from Wiley, and 316 from Taylor and Francis. Of these, initial screening was carried out based on the criteria of publication year (range 2019–2024), English language, full-text access, and open access, resulting in 233 articles for further review with 1,119 articles eliminated. A total of 121 articles were eliminated due to inconsistent title and abstract, 93 articles were removed due to duplication and general review nature, and 6 articles did not meet the assessment with the JBI format. A total of 13 articles that met the inclusion criteria were finally selected for further analysis. The articles included a total of 2,455 deliveries, of which 2,277 cases of SPA were from cohort and case-control studies.

Critical Appraisal

Critical review was conducted using the JBI format adapted to cohort and case-control study designs. The JBI format for cohort studies includes 11 questions, while for case-control studies it consists of 8 questions. The risk of bias of each article was evaluated based on the JBI format criteria. Articles that met the criteria with a score above 70% in the JBI format were 13 articles included in the article analysis. Of the 13 journals, 12 were cohort study articles and 1 was a case-control article.

Bleeding

Bleeding is the main complication in maternal outcomes in cases of SPA, this complication is present in all articles with variations in blood loss volume. Aryananda et al. (2023) noted that the use of telemedicine significantly reduced the volume of intraoperative bleeding. Sentilhes et al. (2022) showed that conservative management has a lower risk of heavy bleeding compared to hysterectomy. Meanwhile, Barinov & Di Renzo (2024) noted that modern surgical techniques reduce average blood loss by almost half compared to old techniques. In a geographical context, McCall et al. (2022) reported significant differences in bleeding management practices in the UK and France, with the UK having a much higher blood loss rate. Blood loss was also less in cases with more optimal interventions, such as multidisciplinary teams (Yao et al., 2023) or early detection (Zhao et al., 2024 ; Collins et al, 2016).

Maternal Death

Maternal mortality has a variable incidence depending on clinical interventions, facility readiness, and management approach. In the study by Aryananda et al. (2023), telemedicine was shown to help manage intraoperative complications, reducing maternal mortality to zero in the telemedicine group. In contrast, emergency delivery increased the risk, as reported by Hanulikova et al. (2024) with a mortality rate of 1.1% in the group. A population-based study by McCall et al. (2022) also showed geographical differences, with maternal deaths occurring in France but not in the UK, reflecting the importance of quality health management. In a further study by McCall et al. (2024), maternal deaths were reported only in the emergency delivery group (Belfort , 2010) .

Organ Injury

Bladder, urinary tract, bowel, and vascular injuries can occur in cases of SPA. Bladder and urinary tract injuries are the most frequently reported organ complications (Aryananda et al., 2023; Barinov & Di Renzo, 2024; Hanulikova et al., 2024; McCall et al., 2022, 2024; Morlando et al., 2021; Yao et al., 2023; Zhao et al., 2024 ; Jauniaux et al, 2024; 2019). With incidence rates varying from 27.3% in patients without telemedicine (Aryananda et al., 2023) to as low as 2.1% with modern surgical techniques (Barinov & Di Renzo, 2024). Urinary tract injuries can also occur, especially in cases of emergency delivery, as reported by Hanulikova et al. (2024), with a rate of 18%. Bowel injury has been reported in approximately 7.5%–7.9% of patients in the UK and France (McCall et al., 2022), whereas vascular injury is rare, as reported in 0.96% of detected SPA cases (Zhao et al., 2024).

Infection

Infectious complications include postpartum infections, endometritis, and surgical site infections. McCall et al. (2022) reported that postpartum infections have a low prevalence of 2.2% in the UK and 1.4% in France, with no significant differences between populations. Sentilhes et al. (2022) study found that endometritis was more common in patients with conservative management (10.8%) compared to hysterectomy, indicating a higher risk due to the placenta being left in situ. In the case of surgical site infection, (McCall et al., 2024) recorded a prevalence of 3.9% in emergency deliveries, indicating a higher risk compared to planned deliveries.

Thromboembolism

Thromboembolic complications have varying prevalence based on clinical intervention. Hanulikova et al. (2024) showed that the risk of deep vein thrombosis was slightly higher in emergency delivery compared to scheduled delivery. In the study by McCall et al. (2022), pelvic artery embolization was reported to be more common in the UK than in France. In

contrast, Sentilhes et al. (2022) revealed that conservative management had a significantly higher risk of pelvic artery embolization compared to hysterectomy.

Vesicovaginal fistula

Vesicovaginal fistula is the presence of an abnormal channel between the bladder and vagina. Hanulikova et al. (2024) reported a higher incidence of vesicovaginal fistula in scheduled deliveries compared to emergencies (3.2% vs. 1.1%). Meanwhile, Paping et al. (2024) showed a higher risk of fistula in the group with placenta left in situ (10.0%) compared to patients who underwent hysterectomy (1.6%). In another article, (McCall et al., 2024) identified that genitourinary fistula complications occurred in a small percentage of patients, with a rate of 0.9% in planned deliveries and 1.9% in emergencies.

Special Inpatient Care

ICU admission is a requirement for intensive care in patients with PAS. Most studies report high ICU requirements, especially in cases with severe bleeding complications. Aryananda et al. (2023) showed that the use of telemedicine did not significantly reduce ICU requirements, with hospitalization rates remaining high (>77%). A study by McCall et al. (2022) noted geographic differences, with patients in the UK having a higher proportion of ICU admissions (68.7%) than in France (30%). Hanulikova et al. (2024) found that ICU requirements were greater in emergency deliveries (58%) than scheduled deliveries (44.1%). A multidisciplinary team approach, as reported by Yao et al. (2023), significantly reduced ICU requirements from 27.1% to 12.7%. Other articles, such as Sharami et al. (2024), showed that all patients with PAS required ICU.

Other outcomes in cases of SPA that can occur, such as intra-abdominal abscess, abdominal bleeding, and hemorrhagic shock. Aryananda et al. (2023) identified intra-abdominal abscess in 13.6% of patients without telemedicine. Meanwhile, abdominal cavity bleeding, as reported by Simonetti et al. (2023), was more frequent in the classical hysterectomy technique (11.1%) compared to the retrograde extraperitoneal technique (8.3%). Hemorrhagic shock, although rare, is an indication of severe bleeding that is difficult to control, as reported in the article by Morlando et al. (2021), where shock occurred in one patient in each delivery group.

DISCUSSION

This study comprehensively evaluates maternal outcomes in labor with placenta accreta spectrum (PAS). PAS is a potentially life-threatening clinical condition because it increases the possibility of severe postpartum hemorrhage, thus having a high risk of maternal morbidity and mortality. 75% of all maternal deaths are caused by severe hemorrhage and most hemorrhages occur after delivery. In addition to bleeding, maternal outcomes that can occur in labor with PAS include organ injury, infection, thromboembolism, vesicovaginal fistula, which requires intensive care and can even cause maternal death.Bleeding is a major complication that triggers the need for large blood transfusions and often requires intensive hospitalization related to patient observation and stabilization. Bleeding in placenta accreta is mainly caused by abnormal placental attachment to the myometrium or abnormal invasion of placental trophoblasts, where the chorionic villi of the placenta penetrate deeper than the decidua basalis layer and reach the uterine myometrium. This condition causes the placenta to be unable to detach spontaneously after delivery, resulting in massive postpartum hemorrhage if forced removal is performed (Khillan et al., 2023; Shepherd & Mahdy, 2022 ; Warshak et al, 2010; Oyelese & Smulian , 2006) . The volume of blood loss varies between 1000 mL to more than 3000 mL depending on the management approach used. Modern approaches such as the use of telemedicine technology, the latest surgical techniques, and multidisciplinary teams have been shown to reduce the volume of bleeding and the need for transfusion. Factors

such as delayed diagnosis and lack of preparedness of medical facilities contribute to higher bleeding in emergency cases.

Organ injury in cases of SPA is still related to the abnormal invasion of placental trophoblasts that occurs. SPA is determined by the level of placental trophoblast invasion into the uterine wall and/or surrounding organs (El Gelany et al., 2019 ; Silver et al, 2015). The classification related to SPA according to the International Federation of Gynecology and Obstetrics (FIGO), is divided into three grades, where in grade 3c, or the highest grade, placental villi can invade the broad ligament, vaginal wall, pelvic side wall, or other pelvic organs (with or without invasion of the bladder) (Jauniaux et al., 2019). So that mothers with this grade of SPA are at high risk of experiencing organ injury. More sophisticated surgical techniques, early detection, and a multidisciplinary approach can significantly reduce the risk of organ injury that may occur in childbirth with SPA. Organ injury, especially to the urinary tract, will also have an impact on other maternal outcomes, namely vesicovaginal fistula where there is an abnormal channel between the bladder and vagina.In the case of SPA, almost all deliveries are performed by surgery, so that thromboembolic complications and infections can occur. Thromboembolism is a medical condition that occurs when a blood clot (thrombus) forms in a blood vessel and blocks another blood vessel, usually in the extremities and can also be in the blood vessels in the lung (Purwanto, 2013). Surgery increases the occurrence of thromboembolism, this is related to vascular injury that occurs during surgery and impaired blood flow caused by immobilization or the influence of surgery (Kang et al., 2022 ; Tikkanen et al, 2011). In addition to thromboembolism, surgery can also cause infection through exposure to tissue and organs, contamination during the procedure (Tekam et al., 2023).

The Intensive Care Unit (ICU) is a special section of a hospital designed to provide advanced care and intensive monitoring for patients in critical conditions. This unit is equipped with sophisticated medical equipment and is managed by health workers who have expertise in handling severe and life-threatening conditions. One of the criteria for patients treated in the ICU is patients who undergo high-risk surgery and require intensive monitoring and post-operative support (Stretch & Shepherd, 2023). In cases of PAS, almost all high-risk operations require intensive hospitalization, this is related to complications of severe bleeding, the need for transfusions, and complications that require close observation after delivery. This can be seen in the study of Sharami et al. (2024), where all patients with PAS required ICU compared to only 6.17% in the control group without PAS. There are limitations to clinical data in each study, such as the lack of detailed reports on the duration of ICU stay, so it is not known how long ICU care is given. The need for ICU care in patients with PAS is highly dependent on the type of management, surgical approach, and the availability of a trained medical team or supporting technology. Proactive management strategies and multidisciplinary teams have been shown to significantly reduce complications and ICU requirements.Some specific outcomes, such as hemorrhagic shock or intra-abdominal abscess, have only been reported in a few journals, making it difficult to draw consistent conclusions, even though in these cases bleeding is the trigger for these complications. Furthermore, the lack of long-term data, such as impact on quality of life or re-hospitalization, limits understanding of the long-term consequences of maternal outcomes experienced by women with placenta accreta spectrum deliveries.

The strengths of this systematic review include the analysis of 13 articles with various research designs, including retrospective, prospective, and case-control cohorts, taken from leading academic databases such as ScienceDirect, ProQuest, Wiley, and Taylor and Francis, providing a broad and diverse data coverage. However, this is also a weakness of the study, because it only used 4 databases, although these sources include leading academic journals,

there is still a possibility that other relevant research articles were not included in this analysis, which could limit the scope and representativeness of the research results. The total sample size of the studies used included 2,455, with 2,277 cases of SPA. Another strength of this study is the assessment of the risk of bias through critical appraisal using the JBI format ensuring that the articles analyzed had good methodological quality, the majority with scores above 70%.Differences in population and study location are also challenges, as clinical management standards and access to health facilities vary across countries. Several studies with small sample sizes and limited observation time, such as studies with samples of less than 30 and using purposive sampling techniques, increase the risk of selection bias and lack of representativeness. These limitations indicate the need for further studies with more varied designs, larger sample sizes, and evaluation of long-term outcomes to provide a more accurate picture of SPA management.

CONCLUSION

Maternal outcomes from delivery of mothers with placenta accreta spectrum include bleeding, organ injury, infection, thromboembolism, vesicovaginal fistula, care in a special room, and maternal death, where bleeding is the main outcome of SPA cases. Other specific maternal outcomes, such as hemorrhagic shock or intra-abdominal abscesses can occur because they are related to severe bleeding experienced by the mother. These maternal outcomes are closely related to the type of intervention applied. A planned approach, such as the use of modern surgical techniques, multidisciplinary teams, and technology, conservative management, labor planning, and early detection has proven effective in reducing these complications. Differences in access to technology and resources may also impact maternal outcomes. Therefore, optimal management of PAS requires a combination of technology-based strategies, multidisciplinary collaboration, and well-planned interventions. These findings provide guidance for improving maternal outcomes in PAS patients as well as a basis for further research and improvement of clinical practice in the future.

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