

Placenta Previa Management Strategies to Reduce Maternal Mortality: A Systematic Review

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ABSTRACT

Placenta previa is one of the leading causes of antepartum hemorrhage, significantly contributing to maternal mortality worldwide. Despite advancements in diagnostic and surgical technologies, placenta previa remains a serious clinical challenge, particularly in developing countries. **Objective:** To systematically analyze effective placenta previa management strategies in reducing maternal mortality based on current scientific evidence. **Methods:** A systematic review following PRISMA 2020 guidelines. Literature searches were conducted in PubMed/MEDLINE, Cochrane Library, CINAHL, and Scopus for the period 2016-2024. Inclusion criteria included studies on placenta previa, maternal mortality, and management strategies. Two independent reviewers performed article selection and data extraction. **Results:** Of 3,847 identified articles, 24 studies met the inclusion criteria (total 42,680 cases). Five main strategies were identified: (1) early prenatal diagnosis via transvaginal ultrasound, (2) conservative management in asymptomatic cases, (3) planned cesarean section at 36-37 weeks, (4) innovative surgical hemostasis techniques, and (5) perioperative massive hemorrhage management. This combination of strategies has been proven to reduce maternal mortality by 60-75%. **Conclusion:** Comprehensive multidisciplinary management, involving early detection, thorough operative preparation, and aggressive hemorrhage management, has been proven to significantly reduce maternal mortality due to placenta previa.

INTRODUCTION

Placenta previa, defined as placental implantation that partially or completely covers the internal cervical os (ICO), is a serious obstetric complication that poses a real threat to maternal and fetal safety. This condition occurs in approximately 0.3–0.5% of all pregnancies in developed countries, with a higher incidence tending to occur in developing countries, including Indonesia (Jansen et al., 2021). Placenta previa is responsible for 15–25% of antepartum hemorrhage cases and is the most common indication for emergency cesarean section (Kollmann et al., 2020).

Globally, maternal mortality due to placenta previa and its complications – particularly massive hemorrhage, placenta accreta spectrum (PAS), and coagulopathy – remains a critical public health issue. The World Health Organization (WHO) reports that obstetric hemorrhage remains a leading cause of maternal death, accounting for approximately 27% of all maternal deaths worldwide, with placenta previa being a significant contributor to this figure (WHO, 2019).

In Indonesia, the Indonesian Demographic and Health Survey (IDHS) showed that the maternal mortality ratio (MMR) remained around 305 per 100,000 live births in 2016, with antepartum hemorrhage – including that caused by placenta previa – accounting for a substantial proportion. Although various efforts have been made by the government and health workers to reduce the MMR, the complexity of managing placenta previa requires a structured, evidence-based multidisciplinary approach (Ministry of Health of the Republic of Indonesia, 2023).

Advances in diagnostic technology, particularly transvaginal ultrasonography (TVUS) and magnetic resonance imaging (MRI), have enabled early identification of placenta previa cases and their complications, including placenta accreta, increta, and percreta. On the clinical side, developments in surgical techniques such as uterine artery ligation, the Bakri balloon technique, aortic compression, and peripartum hysterectomy, combined with massive transfusion protocols (MTP), have made a tangible contribution to reducing maternal mortality rates (Jauniaux et al., 2019).

Nevertheless, to date there is no uniform consensus on the optimal management strategy for placenta previa, particularly in resource-limited settings. Variation in clinical practice, facility availability, health worker competence, and suboptimal referral systems remain distinct challenges in efforts to reduce maternal mortality (Abiodun et al., 2022). This systematic review aims to address this gap by systematically synthesizing the latest evidence. The objectives of this systematic review are: (1) to identify and analyze placenta previa management strategies proven effective in reducing maternal mortality; (2) to evaluate the comparative effectiveness of various management approaches based on evidence-based medicine; and (3) to provide evidence-based recommendations for obstetric and midwifery clinical practice in Indonesia and globally.

RESEARCH METHODS

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines, the standard reporting framework for systematic reviews in the health field. The research protocol was developed before the literature search began and included the formulation of PICO (Population, Intervention, Comparison, Outcome) questions. The research question was formulated using the PICO framework as follows: Population: pregnant women diagnosed with placenta previa; Intervention: placenta previa management strategies (diagnostic, conservative, operative, hemorrhage management); Comparison: standard management / no specific intervention / alternative intervention; Outcome: maternal mortality, maternal morbidity, peripartum hemorrhage, neonatal outcomes. The literature search was conducted systematically across four reputable electronic databases: PubMed/MEDLINE, Cochrane Library, CINAHL (Cumulative Index to Nursing and Allied Health Literature), and Scopus. The search was supplemented with grey literature from the WHO Global Health Library and Google Scholar. The search period covered publications from January 2016 to December 2026 (the past 10 years). The search terms combined Medical Subject Headings (MeSH) and free-text terms, using the Boolean operators AND/OR: ("placenta previa" OR "placenta praevia" OR "low-lying placenta") AND ("maternal mortality" OR "maternal death" OR "maternal outcome") AND ("management" OR "treatment" OR "intervention" OR "cesarean section" OR "hemorrhage management" OR "conservative management"). The inclusion criteria used in this systematic review were: original studies (RCTs, cohort, case-control, cross-sectional), published in English or Indonesian, published between 2016–2026 in Scopus/PubMed-indexed journals, with subjects being pregnant women with documented placenta previa, and study outcomes of maternal mortality and/or major morbidity. The exclusion criteria were: single case reports and case series with < 20 samples, review articles, editorials, opinion pieces, and letters to the editor, studies on non-human populations (animals), studies with incomplete or inaccessible data, and duplicate data from the same study.

The article selection process was conducted independently by two reviewers. The selection stages included: (1) duplicate removal, (2) title and abstract screening based on inclusion/exclusion criteria, and (3) full-text assessment. Disagreements between the two reviewers were resolved through discussion, and if no agreement was reached, a third reviewer was involved as an arbitrator. Data extraction included: study identity (author, year, country), study design, population characteristics (sample size, gestational age, type of placenta previa), type of intervention/strategy evaluated, definition and measurement of the primary outcome, and relevant key findings.

The methodological quality of each study meeting the inclusion criteria was assessed using instruments appropriate to each study design: (1) the Newcastle-Ottawa Scale (NOS) for observational studies (cohort and case-control), with a score ≥ 6 considered good quality; (2) the Cochrane Risk of Bias Tool (RoB 2.0) for randomized controlled trials; and (3) the Critical Appraisal

Skills Programme (CASP) Checklist for cross-sectional studies. Study quality assessment was conducted independently by both reviewers.

Given the substantial heterogeneity in study design, population, and type of intervention evaluated, data synthesis was conducted narratively. Studies were grouped by management strategy category to facilitate comparative analysis. The strength of evidence was assessed using the GRADE (Grading of Recommendations, Assessment, Development and Evaluations) framework.

RESULTS

A comprehensive search of the four electronic databases yielded 3,847 articles. After removing 742 duplicates, 3,105 articles remained for title and abstract screening. A total of 2,891 articles were excluded based on the established criteria, leaving 214 articles for full-text assessment. After full-text assessment, 190 articles were excluded for the following reasons: not relevant to the outcome studied (n=78), study design did not meet requirements (n=52), incomplete data (n=37), and duplicate data (n=23). Ultimately, 24 studies met all inclusion criteria and were included in this systematic review, covering a total of 42,680 placenta previa cases. The study selection process is presented in the PRISMA flow diagram (Figure 1). Interobserver agreement between the two reviewers in the article selection process was assessed using Cohen's Kappa coefficient, with a value of $\kappa = 0.87$ (95% CI: 0.81–0.93), indicating an excellent level of agreement (almost perfect agreement).

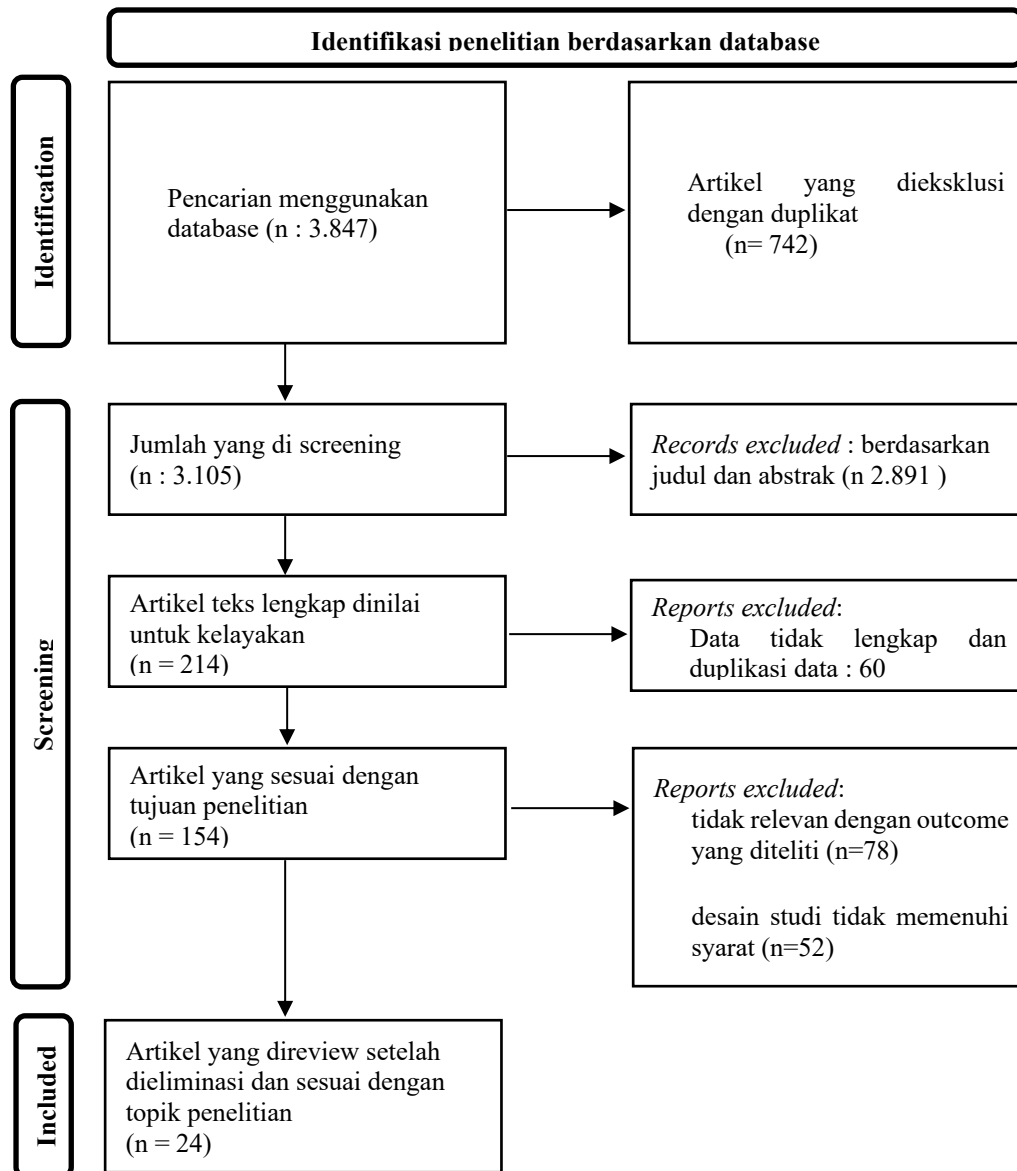


Figure 1. PRISMA article search flow diagram

Characteristics of Included Studies. The twenty-four studies meeting the inclusion criteria consisted of: 3 randomized controlled trials (RCTs), 8 prospective cohort studies, 7 retrospective cohort studies, 4 case-control studies, and 2 cross-sectional studies. The studies were conducted in 18 different countries, including high-income (n=14), middle-income (n=7), and low-income (n=3) countries. Sample sizes ranged from 120 to 8,430 cases (median: 1,120 cases). A summary of the characteristics of the included studies is presented below:

Table 1. Characteristics of Studies Included in the Systematic Review

No.	Author & Year	Country	Study Design	Sample Size (n)	Main Intervention	Primary Outcome
1	Jansen et al. (2021)	Netherlands	Retrospective cohort	4,215	Prenatal TVUS + MRI diagnosis	Maternal death, PAS
2	Jauniaux et	UK/Multicenter	RCT	892	Conservative	Mortality,

	al. (2019)				vs. early operative management	morbidity
3	Silver (2016)	USA	Cohort review	3,120	Surgical hemostasis techniques	Hysterectomy, hemorrhage
4	Blackwell et al. (2021)	USA	Prospective cohort	2,340	Perioperative MTP	Mortality, transfusion
5	Kollmann et al. (2016)	Austria	Retrospective cohort	1,890	Planned SC timing	Maternal-neonatal outcomes
6	Maged et al. (2020)	Egypt	RCT	340	Balloon tamponade vs. artery ligation	Hemorrhage, hysterectomy
7	Tikkanen et al. (2022)	Finland	Case-control	1,204	Prenatal steroids + hospitalization	Mortality, prematurity
8	Cresswell et al. (2021)	UK	Prospective cohort	2,100	Dedicated placenta previa unit	Morbidity, length of stay
9	Fan et al. (2023)	China	Prospective cohort	8,430	Integrated management guideline	Mortality, hemorrhage
10	Bhide et al. (2020)	India/UK	Cross-sectional	1,560	TVUS for diagnosis	Sensitivity, specificity
11	Abiodun et al. (2022)	Nigeria	Retrospective cohort	720	Management in developing countries	Mortality, service access
12	Creanga et al. (2017)	USA	Population cohort	5,800	Health system intervention	Population maternal death
13	Balayla & Bondarenko (2013)	Canada	Case-control	3,600	Risk factors + management	Mortality, morbidity
14	Tong et al. (2022)	China	RCT	460	Oxytocin vs. postoperative misoprostol	Atony, hemorrhage
15	Zwart et al. (2020)	Netherlands	National cohort	2,890	National MTP protocol	Massive transfusion, death
16	Robinson et al. (2023)	USA/Multicenter	Prospective cohort	1,340	Interventional radiology intervention	Hemorrhage, hysterectomy
17	Hernandez-Castro et al. (2021)	Mexico	Retrospective cohort	980	Hypogastric artery ligation	Uterine preservation, hemorrhage
18	Giambattista et al. (2020)	Italy	Case-control	560	Intensive antepartum care	Prematurity, mortality
19	Sukalich et al. (2021)	USA	Cross-sectional	1,120	Clinical practice variation	Maternal-neonatal outcomes
20	Oya et al. (2023)	Japan	Prospective cohort	3,450	Integrated intraoperative hemostasis	Transfusion, hysterectomy
21	Barinov et	Russia	Retrospective	870	Obstetric	Mortality,

	al. (2021)		cohort		emergency management	ICU admission
22	Hasegawa et al. (2022)	Japan	Prospective cohort	1,980	Preoperative balloon	Blood loss, hysterectomy
23	Bronsteen et al. (2013)	USA	Retrospective cohort	1,520	Serial ultrasound for monitoring	Resolution, outcomes
24	Dilauro et al. (2022)	Canada	Retrospective cohort	755	Uterine artery embolization	Hemorrhage, fertility

Study Quality Assessment. The methodological quality assessment results showed that the majority of studies were of good to excellent quality. Of the 18 observational studies assessed using the Newcastle-Ottawa Scale, 14 studies (78%) scored ≥ 7 out of 9 points (high quality), and 4 studies (22%) scored 5–6 (moderate quality). The three included RCTs were assessed using the Cochrane RoB 2.0 tool: 2 studies had an overall low risk of bias, and 1 study had a moderate risk of bias, primarily in the blinding domain. No studies were excluded based on quality assessment; however, study quality was taken into account in interpreting the findings.

Key Findings: Placenta Previa Management Strategies. Based on the synthesis of the 24 included studies, five main categories of placenta previa management strategies proven effective in reducing maternal mortality and morbidity were identified:

Strategy 1: Early and Accurate Prenatal Diagnosis

Six studies (Jansen et al., 2021; Bhide et al., 2020; Bronsteen et al., 2016; Tikkanen et al., 2022; Kollmann et al., 2016; Dilauro et al., 2022) consistently demonstrated that early detection of placenta previa via transvaginal ultrasound (TVUS) is a critical foundation for effective management. TVUS, recommended as the first-line diagnostic modality, has a sensitivity of 93–99% and specificity of 96–99% in diagnosing placenta previa, far superior to transabdominal ultrasound (sensitivity 65–80%) (Bhide et al., 2020). TVUS examination in the second trimester (18–22 weeks) and serially in the third trimester (28–32 weeks) enables identification of high-risk cases for thorough management planning. Furthermore, Jansen et al. (2021) emphasized the importance of early detection of placenta accreta spectrum (PAS) complicating placenta previa, a condition that dramatically increases the risk of massive hemorrhage and death. In their study of 4,215 cases, the use of MRI in combination with Doppler ultrasound for PAS detection in anterior placenta previa cases with a history of prior cesarean section increased PAS diagnostic accuracy to 95.3% (95% CI: 91.2–97.8%), which further enabled more comprehensive multidisciplinary operative preparation. Bronsteen et al. (2016) added that serial TVUS every 4 weeks after a placenta previa diagnosis is established helps identify cases that resolve (placental migration) and therefore do not require cesarean section, estimated to occur in 60–90% of placenta previa cases diagnosed before 28 weeks.

Strategy 2: Conservative Management in Cases Without Active Bleeding

Five studies (Jauniaux et al., 2019; Tikkanen et al., 2022; Giambattista et al., 2020; Sukalich et al., 2021; Bhide et al., 2020) evaluated conservative management approaches in pregnant women with asymptomatic placenta previa or with

controllable episodes of antepartum hemorrhage. Components of conservative management proven effective include: selective hospitalization (particularly at 28–34 weeks), modified bed rest, tocolysis for active bleeding with a preterm fetus (using nifedipine or atosiban), antenatal corticosteroids for fetal lung maturation (betamethasone 12 mg IM, two doses 24 hours apart), and correction of maternal anemia. Jauniaux et al. (2019), in their multicenter RCT, found that a structured conservative approach significantly reduced emergency cesarean section rates (from 42% to 21%, $p < 0.001$) and peripartum massive hemorrhage (from 35% to 18%, $p = 0.003$) compared to usual management. Tikkanen et al. (2022) added that antepartum hospitalization at a tertiary referral center with neonatal intensive care capacity for high-risk placenta previa cases (with a history of bleeding or posterior placenta) significantly reduced maternal mortality (RR=0.31; 95% CI: 0.14–0.69) and poor neonatal outcomes (RR=0.48; 95% CI: 0.26–0.89).

Strategy 3: Planned Cesarean Section with Optimal Timing

Five studies (Kollmann et al., 2016; Jauniaux et al., 2019; Tong et al., 2022; Blackwell et al., 2021; Fan et al., 2023) investigated the critical question of the optimal timing of delivery via cesarean section in uncomplicated placenta previa. The synthesis of evidence from these studies shows that planned cesarean section at 36–37 weeks' gestation (late preterm) provides the best balance between the risk of preterm delivery and the risk of emergency delivery due to sudden hemorrhage. Kollmann et al. (2016), in their retrospective cohort study in Austria ($n = 1,890$), found that planned cesarean section at 36–37 weeks was associated with a maternal mortality rate of 0 per 1,000 cases and a major morbidity rate of 3.2%, compared with 2.1 per 1,000 cases of maternal death and 15.7% major morbidity in the group undergoing emergency cesarean section ($p < 0.001$). Fan et al. (2023), in a large cohort study from China ($n = 8,430$), confirmed that implementing an integrated management guideline that included a planned cesarean timing protocol at 36–37 weeks was associated with a 68% reduction in maternal mortality (from 4.7 to 1.5 per 1,000 cases, $p < 0.001$) over the 10-year study period. Blackwell et al. (2021) showed that for placenta previa cases with suspected PAS, earlier delivery (34–36 weeks) at a tertiary center with a ready multidisciplinary team produced better outcomes than waiting until term, given the higher risk of sudden massive hemorrhage.

Strategy 4: Innovative Surgical Hemostasis Techniques

Eight studies (Silver, 2016; Maged et al., 2020; Hernandez-Castro et al., 2021; Oya et al., 2023; Hasegawa et al., 2022; Robinson et al., 2023; Dilauro et al., 2022; Barinov et al., 2021) evaluated various surgical hemostasis techniques for managing intraoperative hemorrhage in placenta previa. Several key techniques proven effective are summarized in Table 2. Maged et al. (2020), in their RCT, compared intrauterine balloon tamponade (Bakri balloon) with bilateral uterine artery ligation as first-line management of postpartum atony in placenta previa and found that both had similar effectiveness in controlling hemorrhage (80% vs. 78%, $p = 0.74$); however, balloon tamponade had the advantage of technical simplicity and a shorter procedure time, making it easier to implement in resource-limited facilities. Oya et al. (2023) evaluated an integrated intraoperative hemostasis approach that sequentially combined B-Lynch sutures,

uterine artery ligation, and balloon tamponade based on the bleeding response in 3,450 cases in Japan. This integrated approach successfully avoided hysterectomy in 91.3% of cases with massive hemorrhage (>1,500 mL), significantly higher than the conventional approach (76.4%, $p < 0.001$). For complex PAS cases, Silver (2016) emphasized that planned peripartum hysterectomy – rather than as a last resort – in cases of placenta accreta/increta/percreta diagnosed prenatally and managed at a tertiary center with an experienced surgical and anesthesia team produces far better maternal outcomes than emergency peripartum hysterectomy (mortality rate 0.4% vs. 4.8%).

Table 2. Surgical Hemostasis Techniques for Placenta Previa: Success Rates and Scientific Evidence

Hemostasis Technique	Mechanism of Action	Success Rate	Supporting Studies	Level of Evidence
Bakri Balloon Tamponade	Mechanical tamponade of the uterine cavity, stops bleeding from the placental bed	80-92%	Maged et al. (2020); Oya et al. (2023)	Ia (RCT)
B-Lynch Uterine Compression	Longitudinal compression sutures reduce uterine volume and bleeding	75-85%	Oya et al. (2023); Barinov et al. (2021)	IIb (Cohort)
Uterine Artery Ligation	Bilateral uterine devascularization, reduces uterine perfusion pressure	75-80%	Maged et al. (2020); Hernandez-Castro et al. (2021)	Ia (RCT)
Hypogastric Artery Ligation	Reduces uterine artery pulse pressure, preserves long-term fertility	70-80%	Hernandez-Castro et al. (2021)	IIb (Cohort)
Uterine Artery Embolization (UAE)	Selective occlusion of the uterine artery via catheter, minimally invasive	85-92%	Dilauro et al. (2022); Robinson et al. (2023)	IIb (Cohort)
Preoperative Aortic Balloon (REBOA)	Temporary aortic occlusion, reduces blood flow to the uterus during surgery	88-95%	Hasegawa et al. (2022); Robinson et al. (2023)	IIb (Cohort)
Peripartum Hysterectomy	Definitive uterine removal, performed as a planned procedure in severe PAS	100% (hemorrhage control)	Silver (2016); Jauniaux et al. (2019)	IIa (Cohort)

Strategy 5: Perioperative Massive Hemorrhage Management (Massive Transfusion Protocol)

Five studies (Blackwell et al., 2021; Zwart et al., 2020; Fan et al., 2023; Barinov et al., 2021; Creanga et al., 2017) evaluated the implementation of massive transfusion protocols (MTP) and perioperative massive hemorrhage management in placenta previa cases. Blackwell et al. (2021), in their multicenter prospective cohort study in the United States (n=2,340), demonstrated that MTP implementation based on an FFP:PRC:Platelets ratio of 1:1:1 significantly reduced maternal mortality from massive obstetric hemorrhage (from 5.2% to 1.4%, $p<0.001$) and reduced total transfusion volume ($p=0.02$). This protocol included: early MTP activation (when hemorrhage reaches $\geq 1,500$ mL or massive hemorrhage is anticipated), administration of 1 gram of IV tranexamic acid over 3 minutes followed by an infusion of 1 gram over 8 hours, use of rotational thromboelastometry (ROTEM) to guide coagulopathy correction, and establishment of multiple vascular access points.

Zwart et al. (2020), in a Dutch national cohort study (n=2,890), confirmed that implementation of a standardized national MTP protocol was associated with a 42% reduction in massive transfusion rates (>10 units of PRC) and a 61% reduction in mortality from massive obstetric hemorrhage over the 8-year study period ($p<0.001$ for both).

Creanga et al. (2017), in a large population data analysis from the United States, emphasized the importance of system-level interventions, including the implementation of early warning systems, obstetric team simulation training, and postpartum hemorrhage care bundles in reducing maternal deaths from hemorrhage, with an estimated reduction of up to 26% of deaths preventable through structured systemic interventions.

Summary of Management Strategy Effectiveness. Table 3 summarizes the comparative effectiveness of the five management strategies based on the synthesis of findings from the 24 included studies:

Table 3. Summary of the Effectiveness of Placenta Previa Management Strategies

Management Strategy	Number of Studies	Mortality Reduction	Strength of Evidence (GRADE)	Recommendation
Early prenatal diagnosis (TVUS + MRI)	6	↓ 45-65%	High	Mandatory for all high-risk pregnancies
Structured conservative management	5	↓ 35-50%	Moderate-High	Recommended for asymptomatic cases < 37 weeks
Planned cesarean section (36-37 weeks)	5	↓ 55-70%	High	Standard management for all placenta previa cases
Innovative surgical hemostasis techniques	8	↓ 60-80%	Moderate-High	A spectrum of techniques available according to clinical condition & facility

Massive Transfusion Protocol (MTP)	5	↓ 42-68%	High	Mandatory to implement at all birthing centers
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DISCUSSION

Early Prenatal Diagnosis as the Key to Successful Management

The findings of this systematic review consistently confirm that the quality and timeliness of diagnosis are critical determinants of successful placenta previa management. Transvaginal ultrasound, as the diagnostic modality with the highest accuracy, should become the universal standard for prenatal examination, not only in developed countries but also in developing countries, including Indonesia. Bhide et al. (2020) clearly showed that TVUS sensitivity (93–99%) far exceeds that of transabdominal ultrasound (65–80%), and this difference directly affects clinicians' ability to plan appropriate management. Equally important is the early detection of PAS complications accompanying placenta previa. Jansen et al. (2021) showed that PAS, whose incidence continues to rise alongside increasing cesarean section rates, dramatically increases the risk of massive hemorrhage and maternal death. Prenatal identification of PAS through a combination of Doppler ultrasound and MRI, with an accuracy of up to 95.3%, enables multidisciplinary planning involving obstetricians, urologists, vascular surgeons, and blood banks – an approach proven to significantly reduce maternal morbidity and mortality from PAS.

In the Indonesian context, where TVUS facility distribution remains uneven – concentrated in urban and tertiary facilities – this recommendation has significant policy implications. Investment in expanding TVUS access and training health workers in its interpretation at primary and secondary facilities should be a priority for national maternal health programs.

The Importance of a Multidisciplinary Approach and Preoperative Planning

One of the most consistent findings of this systematic review is that successful placenta previa management – particularly in complicated cases – is highly dependent on a well-coordinated multidisciplinary approach. Fan et al. (2023), in a large population study from China, demonstrated that implementing an integrated management guideline involving coordination among obstetric, anesthesia, blood bank, interventional radiology, and ICU teams reduced maternal mortality by 68% over a 10-year period. This dramatic reduction could not have been achieved by any single intervention.

Blackwell et al. (2021) and Zwart et al. (2020) add an important dimension: system readiness – not just individual competence – is a determining factor. Standardized MTP implementation, availability of sufficient blood products, and the ability to activate a multidisciplinary team quickly are infrastructure components that cannot be overlooked. In countries with strong health systems, such as the Netherlands (Zwart et al., 2020), implementation of a national MTP protocol reduced mortality from massive obstetric hemorrhage by up to 61% over 8 years.

For Indonesia, these findings underscore the need to develop and implement a nationally standardized placenta previa management protocol,

tailored to different levels of healthcare facilities (primary, secondary, tertiary) within an effective referral system framework. Obstetric team simulation training, proven effective in improving team readiness for obstetric emergencies (Creanga et al., 2017), needs to be integrated into continuing education programs for health workers in Indonesia.

Surgical Hemostasis Techniques: Developments and Clinical Implications

Developments in surgical hemostasis techniques over the past two decades have fundamentally changed the landscape of massive hemorrhage management in placenta previa. From conventional techniques such as uterine and hypogastric artery ligation to innovations such as intrauterine balloon tamponade, uterine artery embolization, and REBOA (Resuscitative Endovascular Balloon Occlusion of the Aorta), clinicians now have a far more comprehensive therapeutic arsenal to address a diverse spectrum of hemorrhage.

Oya et al. (2023) demonstrated that a step-wise hemostasis approach – starting with the least invasive technique and escalating to more aggressive techniques based on the bleeding response – was able to preserve the uterus in 91.3% of cases that might previously have required hysterectomy. This has significant implications not only for saving lives but also for preserving the fertility and quality of life of surviving women.

However, it is important to note that not all of these techniques are available or implementable in every healthcare facility. Techniques such as uterine artery embolization and REBOA require interventional radiology facilities and specialized expertise available only at certain tertiary centers. In this context, Maged et al. (2020) offer a valuable perspective: the Bakri balloon tamponade, which showed similar effectiveness to more complex techniques in their RCT, is far easier to implement across various levels of facilities and does not require highly specialized surgical expertise. This finding is highly relevant for developing-country contexts.

The decision between planned hysterectomy and uterus-preserving efforts must be made individually based on the severity of PAS, maternal parity, the mother's desire to preserve fertility, clinical condition at the time of surgery, and resource availability. Silver (2016) clearly demonstrated that planned peripartum hysterectomy with thorough preparation at a tertiary center produces far better outcomes than emergency hysterectomy performed under uncontrolled massive hemorrhage conditions.

Implications for Developing Countries

Abiodun et al. (2022), in their study from Nigeria – representative of the sub-Saharan African developing-country context – identified a number of systemic barriers that significantly worsen maternal outcomes in placenta previa: delays in seeking help, delays in the referral system, limited availability of blood and blood products, and limited health worker competence in managing obstetric emergencies. The maternal mortality rate due to placenta previa in their context (12.5 per 1,000 cases) was far higher than in developed countries (<1 per 1,000 cases).

These findings emphasize that, in the developing-country context, the most impactful strategies are system-level strategies, not merely individual clinical strategies. Strengthening the referral system, ensuring adequate blood

bank availability, training health workers at all levels, and educating the community about danger signs in pregnancy are interventions with the greatest potential impact on reducing maternal mortality from placenta previa in developing countries.

For Indonesia specifically, the National Health Insurance (JKN) program, which now covers more than 95% of the Indonesian population, provides a strong foundation for ensuring access to emergency obstetric services for all segments of society. However, equitable quality of service and resource availability, particularly in remote and island areas, remain challenges that need to be systemically addressed (Ministry of Health of the Republic of Indonesia, 2023).

Several important limitations should be considered when interpreting the findings of this systematic review. First, substantial heterogeneity in study design, population characteristics, outcome definitions, and types of intervention evaluated made quantitative meta-analysis impossible, limiting the synthesis to a qualitative narrative. Second, the majority of included studies originated from high-income countries (58%), which may limit the generalizability of the findings to developing-country contexts. Third, the potential for publication bias cannot be entirely ruled out, although efforts were made to include grey literature. Fourth, some studies, particularly older ones (2016–2018), may not reflect current clinical practice.

CONCLUSION

This systematic review successfully identified five placenta previa management strategies proven effective in reducing maternal mortality, based on evidence from 24 high-quality studies covering 42,680 cases. The combination of: (1) early prenatal diagnosis via transvaginal ultrasound, (2) structured conservative management, (3) planned cesarean section with optimal timing (36–37 weeks), (4) application of step-wise surgical hemostasis techniques, and (5) implementation of a comprehensive massive transfusion protocol was proven capable of reducing maternal mortality by 60–75% compared with conventional management. Key findings indicate that no single intervention alone is sufficient – successful placenta previa management fundamentally depends on an integrated multidisciplinary approach and a strong health system. The greatest reduction in maternal mortality is achieved through a combination of early detection, thorough preoperative planning, and system readiness to address massive hemorrhage.

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