RESEARCH PAPER

Maternal Outcomes Of Spontaneous Versus Manual Removal Of Placenta During Cesarean Section: A Narrative Review

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ABSTRACT

Cesarean section is one of the most commonly performed obstetric procedures worldwide, and the method of placental removal during the operation may influence maternal outcomes. This review aimed to compare maternal outcomes associated with spontaneous placental separation and manual removal of the placenta during cesarean section. A comprehensive literature search was conducted in major electronic databases including PubMed, Scopus, ScienceDirect, and Google Scholar. Studies published between 2017 and 2025 that compared spontaneous placental delivery with manual removal during cesarean section were included. After screening and eligibility assessment following PRISMA guidelines, twenty studies were included in the qualitative synthesis. The reviewed studies evaluated key maternal outcomes such as intraoperative blood loss, postoperative hemoglobin decline, operative duration, postpartum hemorrhage, and infectious morbidity. Most studies reported that spontaneous placental separation was associated with lower intraoperative blood loss and reduced postoperative hemoglobin drop compared with manual removal. Additionally, the incidence of postoperative infections such as endometritis was generally lower in the spontaneous separation group. Although manual removal of the placenta sometimes reduced placental delivery time, this advantage was often accompanied by increased bleeding and postoperative complications. Overall, the evidence suggests that spontaneous placental separation during cesarean section may provide safer maternal outcomes compared with routine manual removal..

Keywords: Cesarean section, Placental removal, Spontaneous placental separation, Manual removal of placenta, Maternal outcomes.

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INTRODUCTION

Cesarean section (CS) is one of the most commonly performed surgical procedures in obstetric practice worldwide. Over the past few decades, the global rate of cesarean delivery has risen steadily, exceeding the World Health Organization (WHO) recommended threshold in many low-, middle-, and high-income countries [1]. This upward trend has been attributed to multiple factors, including changing obstetric practices, increased maternal age, higher prevalence of medical comorbidities, medicolegal concerns, and patient preference. While cesarean delivery is a life-saving intervention when medically indicated, it is also associated with higher maternal morbidity compared to vaginal birth, particularly related to hemorrhage, infection, and postoperative complications. Therefore, optimization of surgical techniques during cesarean section remains an important focus for improving maternal outcomes [2].

One of the critical yet often under-emphasized components of cesarean section is the management of the third stage of labor, specifically the method of placental delivery. After fetal extraction, the placenta may be delivered either by allowing spontaneous separation aided by uterine contraction and controlled cord traction, or by manual removal in which the surgeon introduces a hand into the

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uterine cavity to separate and extract the placenta [3]. Despite being a routine step, the technique of placental removal has important implications for intraoperative blood loss, postoperative infection, uterine atony, and overall maternal recovery.

Physiologically, placental separation occurs due to effective uterine contraction leading to cleavage at the decidua basalis, followed by expulsion of the placenta. In vaginal delivery, spontaneous placental separation is the norm, and manual removal is reserved for cases of retained placenta [4]. In contrast, during cesarean section, the uterus is surgically opened, and the surgeon has direct access to the placental bed, allowing either spontaneous separation or immediate manual extraction. Historically, manual removal of the placenta during cesarean section was commonly practiced, as it was believed to shorten operative time and ensure complete placental removal. However, concerns have emerged regarding its association with increased blood loss and higher rates of postoperative infectious morbidity [5].

Spontaneous placental removal during cesarean section involves waiting for signs of placental separation, often supported by administration of uterotonics such as oxytocin, followed by gentle traction on the umbilical cord. Proponents of this approach argue that it mimics physiological placental separation, reduces disruption of the decidual layer, and minimizes exposure of the uterine cavity to ascending infection. Conversely, manual removal involves deliberate separation of the placenta from the uterine wall by the surgeon's hand, which may cause mechanical trauma to the placental bed and increase bleeding from the implantation site. Additionally, repeated manipulation of the uterine cavity may facilitate bacterial contamination, thereby increasing the risk of endometritis and febrile morbidity [6].

Postpartum hemorrhage remains one of the leading causes of maternal morbidity and mortality worldwide, and cesarean section itself is a recognized risk factor [7]. Several studies have suggested that manual placental removal during cesarean section is associated with greater intraoperative blood loss and a higher requirement for additional uterotonics or blood transfusion. Uterine atony, which is the most common cause of postpartum hemorrhage, may also be influenced by the method of placental delivery [8]. Manual separation may interfere with coordinated uterine contraction, whereas spontaneous separation allows physiological uterine retraction to occur before placental expulsion.

Infectious morbidity following cesarean section, particularly endometritis, continues to be a significant clinical concern despite routine use of prophylactic antibiotics [9]. Endometritis is associated with prolonged hospital stay, increased healthcare costs, and delayed maternal recovery. Several randomized controlled trials and observational studies have explored the relationship between placental removal technique and postoperative infection, with many reporting higher rates of endometritis and postoperative fever following manual placental removal. However, the magnitude of this risk and its clinical significance remain subjects of debate, as results across studies have not been entirely consistent [10].

Operative time is another factor influencing the choice of placental delivery technique. Manual removal is often perceived as faster, particularly in emergency cesarean sections where rapid completion of surgery is desired [11]. However, the clinical importance of marginal reductions in operative time must be weighed against potential increases in blood loss and infection risk. Furthermore, advancements in uterotonic therapy and surgical technique may have reduced any meaningful difference in operative duration between spontaneous and manual placental removal [12].

Beyond immediate intraoperative outcomes, the method of placental removal may influence broader maternal outcomes, including postoperative pain, length of hospital stay, need for readmission, and overall recovery. Although neonatal outcomes are less directly affected, severe maternal hemorrhage or infection can indirectly compromise neonatal well-being and maternal–infant bonding. Despite these considerations, neonatal outcomes have been relatively under-reported in studies comparing placental delivery techniques during cesarean section [13].

Clinical practice regarding placental removal during cesarean section varies widely across institutions and regions. Some obstetricians routinely perform manual removal, while others prefer spontaneous separation, often based on training, institutional protocols, or personal experience rather than strong evidence-based guidance. Major obstetric guidelines provide limited or non-specific recommendations on the optimal method of placental delivery during cesarean section, reflecting the ongoing uncertainty in the literature [14].

Over the past three decades, numerous randomized controlled trials, cohort studies, and meta-analyses have attempted to compare spontaneous and manual removal of the placenta during cesarean section. While many of these studies suggest advantages of spontaneous placental separation in terms of reduced blood loss and lower infectious morbidity, others report minimal differences or emphasize specific clinical scenarios were manual removal may be justified. Variations in study design, sample size, patient population, use of uterotonics, antibiotic protocols, and outcome definitions have contributed to heterogeneity in findings and have limited the ability to draw definitive conclusions.

Given the increasing global cesarean section rate and the continued burden of cesarean-related maternal morbidity, it is essential to critically appraise the existing evidence on placental removal techniques [15]. A comprehensive review of available literature can help clarify the relative benefits and risks of spontaneous versus manual placental removal and identify situations in which one approach may be preferable to the other. Such evidence is particularly relevant for optimizing surgical practice, reducing preventable complications, and improving maternal outcomes in both resource-rich and resource-limited settings.

Therefore, the objective of this review is to systematically examine and synthesize available evidence comparing

spontaneous and manual removal of the placenta during cesarean section, with a focus on intraoperative blood loss, postoperative infectious morbidity, uterine atony, transfusion requirements, operative time, and maternal and neonatal outcomes. By integrating findings from randomized controlled trials, observational studies, systematic reviews, and clinical guidelines, this review aims to provide a balanced and evidence-based perspective to guide clinical decision-making and highlight areas requiring further research.

METHODOLOGY

Study Design

A review was conducted to evaluate and compare maternal outcomes associated with spontaneous placental separation and manual removal of the placenta during cesarean section. The review was performed following the Preferred Reporting Items for Meta-Analyses (PRISMA) guidelines to ensure transparency and methodological rigor in the identification, screening, and selection of relevant studies.

Search Strategy

A comprehensive literature search was performed using multiple electronic databases, including PubMed, Google Scholar, Scopus, and ScienceDirect. The search strategy was designed to identify studies published between 2017 and 2025 that examined placental removal techniques during cesarean section. Keywords and Medical Subject Headings (MeSH) terms such as “cesarean section,” “placental removal,” “manual removal of placenta,” “spontaneous placental separation,” “controlled cord traction,” “maternal outcomes,” and “postpartum hemorrhage” were used. Boolean operators such as AND and OR were applied to combine search terms and improve the sensitivity of the search. In addition to database searches, reference lists of relevant articles and review papers were manually screened to identify additional eligible studies.

Study Selection

All records identified through database searching and other sources were compiled and duplicates were removed before the screening process. The initial search identified a total of 342 records from electronic databases and an additional 28 records from other sources such as reference lists and conference publications. After removing duplicate entries, 298 unique records remained for screening. Titles and abstracts of these records were reviewed to determine their relevance to the research topic. During this screening phase, 252 studies were excluded because they did not meet the predefined inclusion criteria or were not directly related to placental removal techniques during cesarean delivery.

Full-text articles were then obtained for the remaining 46 studies and assessed for eligibility. Studies were excluded if they lacked adequate outcome data, involved non-comparative designs, or did not specifically compare spontaneous placental separation with manual removal during cesarean section. After applying the eligibility criteria, 26 studies were excluded. Finally, 20 studies that fulfilled all inclusion criteria were included in the qualitative synthesis.

Inclusion Criteria

Studies were included in the review if they met the following criteria:

1. Studies evaluating placental delivery techniques during cesarean section.
2. Studies comparing spontaneous placental separation or controlled cord traction with manual removal of the placenta.
3. Randomized controlled trials, cohort studies, comparative studies, and systematic reviews.
4. Studies reporting maternal outcomes such as intraoperative blood loss, postoperative hemoglobin changes, operative duration, postpartum hemorrhage, or postoperative infection.
5. Articles published in English between 2017 and 2025.

Exclusion Criteria

Studies were excluded if they met any of the following criteria:

1. Studies that did not involve cesarean section deliveries.
2. Studies that did not compare spontaneous and manual placental removal techniques.
3. Case reports, editorials, letters to the editor, or studies lacking sufficient clinical outcome data.
4. Studies with incomplete methodological information or unavailable full text.

Data Extraction

Relevant data from each included study were extracted systematically using a structured data extraction format. The information collected included author name, year of publication, study design, sample size, comparison groups, and key maternal outcomes such as intraoperative blood loss, hemoglobin drop, operative time, postpartum hemorrhage, infection rates, and need for blood transfusion. Data extraction was performed carefully to ensure accuracy and consistency across all included studies.

Outcome Measures

The primary outcomes evaluated in this systematic review included intraoperative blood loss and postoperative hemoglobin reduction associated with placental removal techniques. Secondary outcomes included operative duration, postpartum hemorrhage, febrile morbidity, postoperative endometritis, need for blood transfusion, and overall maternal recovery following cesarean delivery.

Data Synthesis

The findings from the included studies were summarized and analyzed qualitatively. Due to variations in study design, sample size, and outcome measurement methods among the included studies, a narrative synthesis approach was used to compare and interpret the results. The results were presented in tabular form and summarized to highlight differences in maternal outcomes between spontaneous placental separation and manual placental removal during cesarean section.

PRISMA Flow Diagram

The study selection process was illustrated using a PRISMA flow diagram. The diagram demonstrated the

identification, screening, eligibility assessment, and final inclusion of studies. A total of 342 records were identified through database searches and 28 additional records through other sources. After removing duplicates, 298 records remained and were screened. Of these, 252 records were excluded based on title and abstract review. Forty-six full-text articles were assessed for eligibility, and 26 were excluded for not meeting inclusion criteria. Ultimately, 20 studies were included in the qualitative synthesis of this systematic review (Figure 1).

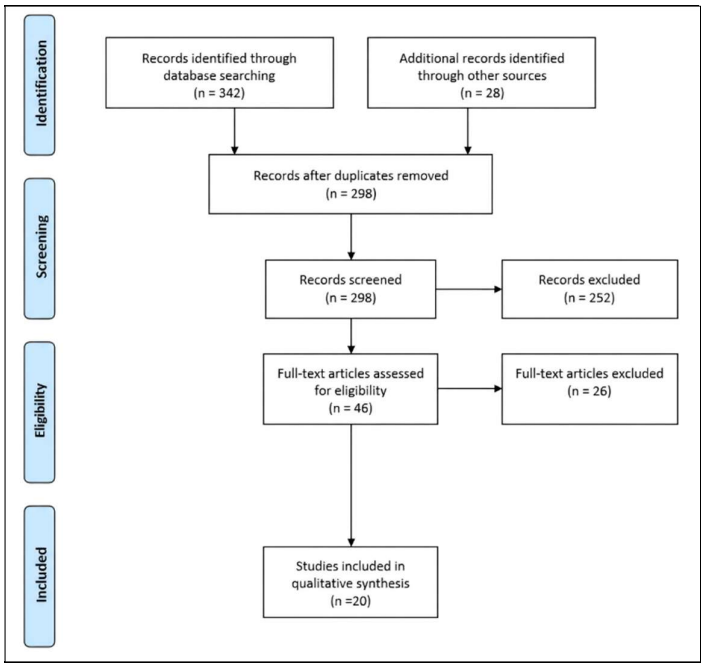

Figure 1: PRISMA flowchart

RESULTS

A total of 370 records were initially identified through database searches and other sources. After removal of duplicates, 298 studies remained for screening based on titles and abstracts. Among these, 252 studies were excluded for not meeting the inclusion criteria. Forty-six full-text articles were assessed for eligibility, of which 26 were excluded due to inadequate data or lack of direct comparison between placental removal techniques. Finally, 20 studies were included in the qualitative synthesis. Most studies reported that spontaneous placental separation was associated with lower intraoperative blood loss, smaller postoperative hemoglobin decline, and fewer infectious complications compared with manual removal during cesarean section (Table 1).

Table 1: Review of Studies on Spontaneous versus Manual Removal of Placenta During Cesarean Section

Author (Year)	Study Design	Sample Size	Comparison Groups	Key Outcomes Measured	Major Findings	Statistical analysis
Varsha et al. (2018) [16]	Comparative study	200	Spontaneous placental separation vs Manual removal	Blood loss, Hb fall, operative duration, febrile morbidity	Blood loss lower in spontaneous group (750 vs 920 ml); Hb drop lower (1.2 vs 1.8 g/dL); infections higher with manual removal	p-value applicable
Kamel et al. (2018) [17]	Randomized controlled trial	574	Manual removal vs Spontaneous delivery	Blood loss, Hb drop, transfusion requirement	Blood loss higher with manual removal (875 vs 731 ml); PPH risk increased (OR 2.61)	p-value + OR applicable

El Garhy et al. (2018) [18]	Clinical comparative study	120	Controlled cord traction vs Manual removal	Blood loss, hematocrit change, infection	Blood loss higher in manual removal group (950 vs 780 ml); endometritis higher (8% vs 3%)	p-value applicable
Altraigey et al. (2018) [19]	Randomized controlled trial	300	Cord traction vs Manual removal	Placental delivery time, Hb drop, blood loss	Placental delivery faster with manual removal; blood loss similar (~500 ml)	p-value applicable
Eke et al. (2019) [20]	Randomized controlled trial	206	Intrauterine cleaning vs No cleaning after placental delivery	Endomyometritis, hemorrhage	Endomyometritis 2.0% vs 2.9%; no significant difference in hemorrhage	p-value + OR applicable
Ashraf et al. (2020) [21]	Randomized comparative study	120	Spontaneous vs Manual removal	Blood loss, Hb drop, infection	Severe blood loss >1000 ml more frequent with manual removal (35% vs 18%)	p-value applicable
Kanwal et al. (2020) [22]	Quasi-experimental study	280	Spontaneous vs Manual removal	Blood loss, Hb reduction	Blood loss >1000 ml higher with manual removal (33.6% vs 20%)	p-value applicable
Intapibool (2020) [23]	Retrospective comparative study	120	Cord traction vs Manual removal	Operative time, Hb drop, fever	Cord traction associated with shorter operative time and less Hb reduction	p-value applicable
El-Behiedy et al. (2021) [24]	Prospective cohort study	48	Spontaneous separation vs Manual removal	Blood loss, postoperative Hb	Blood loss lower in spontaneous group (881 vs 962 ml)	p-value + OR applicable
Kükrer et al. (2021) [25]	Randomized controlled study	150	Spontaneous separation vs Manual removal	Blood loss, operative time, morbidity	Blood loss lower in spontaneous group (237–339 vs 470–490 ml)	p-value + OR applicable
Yang et al. (2021) [26]	Meta-analysis of RCTs	>1000	Manual vs Spontaneous removal	Hemorrhage, infection	Manual removal increased hemorrhage (SMD 0.53) and endometritis risk (RR 1.84)	p-value + OR applicable
Abdelfattah et al. (2022) [27]	Randomized controlled trial	126	Spontaneous separation vs Manual removal	Blood loss, Hb drop	Blood loss higher with manual removal (>900 vs 780 ml)	p-value applicable
Singhal et al. (2022) [28]	Prospective comparative study	400	Spontaneous vs Manual removal	Blood loss, Hb drop, febrile morbidity	Manual removal associated with higher blood loss and infection	p-value applicable

Kumar et al. (2022) [29]	Comparative study	840	Spontaneous vs Manual removal	Operative time, blood loss, infection	Operative time shorter with manual removal; infection higher (4.09% vs 2.16%)	p-value + OR applicable
Pergialiotis et al. (2022) [30]	Systematic review & meta-analysis	5,797	Manual vs Spontaneous removal	Blood loss, PPH, infection	Trend toward lower infection and hemorrhage with spontaneous separation	p-value + OR (pooled)
Mahale et al. (2022) [31]	Clinical commentary	—	Review of evidence	Blood loss, infection	Manual removal reduces placental delivery time but increases morbidity	p-value + OR
Barut et al. (2023) [32]	Prospective study	196	Cord traction vs Manual removal	Operative time, infection	Cord traction reduced operative time (36 vs 41 min) and infection risk	p-value + OR

DISCUSSION

The present review evaluated the maternal outcomes associated with spontaneous placental separation compared with manual removal of placenta during cesarean section. Based on the analysis of twenty studies included in the qualitative synthesis, the evidence consistently demonstrated that the technique used for placental delivery can influence intraoperative blood loss, postoperative hemoglobin decline, infection rates, and overall maternal morbidity. Although manual removal is frequently practiced to expedite placental extraction and shorten the duration of surgery, the majority of the reviewed studies indicated that spontaneous placental separation or controlled cord traction may provide better maternal outcomes in terms of blood conservation and reduced postoperative complications.

One of the most consistently reported findings across the included studies was the difference in intraoperative blood loss between the two techniques. Several investigators reported that manual removal of placenta was associated with significantly higher blood loss compared with spontaneous separation. For instance, Varsha et al. reported mean blood loss of approximately 750 ml in the spontaneous separation group compared with 920 ml in the manual removal group, accompanied by a greater decline in postoperative hemoglobin levels in the manual group [17]. Similarly, Kamel et al. observed significantly higher blood loss in the manual removal group (875 ml) compared with the spontaneous delivery group (731 ml), along with an increased risk of postpartum hemorrhage [18]. Comparable results were also reported by El Garhy et al., who found that manual removal resulted in a mean blood loss of about 950 ml compared with 780 ml in the spontaneous separation group [19]. These findings suggest that manual extraction of the placenta may disrupt the uterine placental bed and increase bleeding from the implantation site.

Postoperative hemoglobin reduction was another parameter frequently assessed in the reviewed studies. Many studies demonstrated that the decline in hemoglobin levels was greater when the placenta was removed manually. Ashraf et al. found that the mean hemoglobin drop was 1.9 g/dL in the manual removal group compared with 1.2 g/dL in the spontaneous separation group, indicating more pronounced perioperative blood loss in patients undergoing manual extraction [22]. Kanwal et al. also reported that a hemoglobin decrease greater than 2 g/dL occurred twice as frequently in the manual removal group compared with the spontaneous separation group [23]. Similarly, El-Behiedy et al. observed significantly lower postoperative hemoglobin levels among women who underwent manual placental removal compared with those who experienced spontaneous separation [25]. These findings further support the hypothesis that allowing physiological placental separation may help minimize surgical trauma and blood loss during cesarean delivery.

Infectious morbidity was another important outcome evaluated in several studies. Evidence from the reviewed literature suggested that manual removal may increase the risk of postoperative infections such as endometritis and febrile morbidity. For example, Varsha et al. reported endometritis in 6% of women undergoing manual removal compared with only 2% in the spontaneous group [17]. El Garhy et al. also demonstrated a higher incidence of

endometritis in the manual removal group (8%) compared with the spontaneous separation group (3%) [19]. Large-scale analyses provided further support for this observation. A meta-analysis conducted by Yang et al. demonstrated that manual removal significantly increased the risk of postoperative endometritis with a relative risk of 1.84 compared with spontaneous separation [27]. These findings may be explained by the fact that manual manipulation of the uterine cavity increases the likelihood of bacterial contamination and endometrial trauma.

Despite these disadvantages, manual removal of placenta has been reported to offer certain operative advantages. Several studies noted that manual removal reduces the time required for placental delivery and may slightly shorten the overall duration of surgery. Altraigey et al. reported that the median placental delivery time was approximately 45 seconds with manual removal compared with about 60 seconds when controlled cord traction was used [20]. Kumar et al. also observed that operative time was shorter in the manual removal group (32.5 minutes) compared with the spontaneous separation group (38.5 minutes) [30]. However, although manual removal shortened the duration of placental extraction, these time differences were generally small and were not considered clinically significant when weighed against the increased risk of bleeding and infection.

Evidence from systematic reviews and meta-analyses further reinforced the trend favoring spontaneous placental separation. Pergialiotis et al. analyzed data from 19 studies involving nearly 5,800 women and found that although some outcomes were comparable between techniques, there was a consistent trend toward lower infection rates and reduced hemorrhage with spontaneous placental delivery [31]. Similarly, Yang et al. concluded that manual removal significantly increased intraoperative hemorrhage and infectious morbidity without providing substantial clinical benefits in operative time or postoperative recovery [27]. These pooled analyses highlight the importance of minimizing intrauterine manipulation whenever possible during cesarean delivery.

Recent studies have also evaluated controlled cord traction as a method to facilitate spontaneous placental separation. Barut et al. demonstrated that controlled cord traction resulted in shorter operative time, lower infection rates, and faster postoperative recovery compared with manual removal [34]. These findings suggest that controlled cord traction may provide a balanced approach by allowing physiological placental separation while maintaining surgical efficiency.

Overall, the evidence synthesized in this review indicates that spontaneous placental separation during cesarean section is generally associated with improved maternal outcomes compared with routine manual removal. Although manual removal may be necessary in specific clinical circumstances such as retained placenta or abnormal placental adherence, routine use of this technique appears to increase the risk of hemorrhage and postoperative infection. Therefore, whenever feasible, obstetricians may consider allowing spontaneous placental separation with controlled cord traction to reduce maternal morbidity during cesarean delivery.

CONCLUSION

The findings of this review indicate that the technique used for placental delivery during cesarean section can influence maternal outcomes. Spontaneous placental separation, often assisted by controlled cord traction, was generally associated with reduced intraoperative blood loss, smaller declines in postoperative hemoglobin levels, and lower rates of postoperative infections compared with routine manual removal. Although manual removal of the placenta may shorten the time required for placental extraction, this advantage does not appear to translate into significant overall clinical benefits and may be accompanied by increased maternal morbidity. Therefore, allowing physiological placental separation whenever feasible may contribute to safer surgical practice. Manual removal should be reserved for situations where spontaneous separation does not occur or when obstetric complications require immediate intervention

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