

A Systematic Review on Maternal Complications in Cesarean Section**Rajesh Gondalia¹, Jagruti D Parmar²**¹Association Professor, Department of Obstetrics & Gynaecology, MPKB Medical College & Research Centre, Atkot, Rajkot District, Gujarat.²Senior Consultant Class - 1 Officer, ESIS General Hospital, Jamnagar, Gujarat

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Corresponding Author: Dr. Rajesh Gondalia

Conflict of interest: Nil

Abstract:**Background:** This systematic review explores maternal complications following Cesarean sections, incorporating diverse study designs and global representation. Eight studies, ranging from cohort to case-control and cross-sectional designs were included in the analysis.**Materials and Methods:** A comprehensive evaluation of studies from India to the United States and Italy was undertaken. Sample sizes varied from 5779 to 286565. Postpartum infection, hemorrhage, hospitalization, obstetric trauma, and maternal death were assessed using relevant risk ratios and odds ratios.**Results:** Studies revealed mixed outcomes for postpartum infection, with elevated risks for puerperal infection and surgical complications following Cesarean sections. Hemorrhage findings were contentious, highlighting a lower risk in some studies but an increased likelihood of blood transfusion post-Cesarean. Hospitalization analyses indicated heightened ICU admission rates and rehospitalisation post-Cesarean. Obstetric trauma risk was lower with Cesarean sections. Maternal death findings varied, indicating an increased risk in Cesarean sections compared to controls, particularly in intrapartum scenarios.**Conclusion:** This synthesis highlights the multifaceted nature of maternal complications following Cesarean sections. Despite limitations, it prompts nuanced clinical considerations for personalized obstetric care, optimizing outcomes while acknowledging the intricate interplay of diverse factors.**Keywords:** Maternal Complications, Cesarean Section, Postpartum Infection, Hemorrhage, Obstetric Trauma, Maternal Death.

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Introduction

Of the several childbirth techniques, Cesarean section (C-section) is one of the most important surgical procedures that provides an essential substitute for the mother's and the baby's safety [1]. Globally, the frequency of Cesarean sections has increased significantly as delivery patterns have changed, indicating a dynamic shift in maternal healthcare [2–5].

In an effort to shed light on the complexities, ramifications, and subtleties surrounding this surgical operation, this systematic review investigates the maternal problems linked to Cesarean sections. A few medical, social, and personal factors might interact to affect the choice to have a Cesarean section [6]. Undoubtedly, C-sections have been essential in reducing the dangers associated with delivery; yet there have been concerns expressed about the possible difficulties that might occur for mothers as a result [7, 8]. It is crucial for legislators, healthcare professionals, and expecting women to recognise and address these issues [9]. A significant aspect of

the discussion around maternal problems following a Cesarean section concerns the rising global prevalence of C-section births [10–12]. Due to this increase, it is imperative that the related maternal risks be thoroughly evaluated to ensure that the advantages and possible disadvantages of this surgical method be carefully weighed [13]. Healthcare practitioners must comprehend maternal difficulties to provide patient-centered treatment and reduce the risk of unfavourable outcomes as the number of C-sections rises [14].

The spectrum of outcomes associated with maternal problems after Cesarean sections include both short-term postoperative issues and long-term consequences [15]. Acute consequences require prompt attention and action, such as infection, bleeding, and problems connected to anaesthesia [16]. In addition, a thorough grasp of the long-term effects is required in order to offer comprehensive and successful healthcare treatments, as well as the possible influence on future pregnancies and the mental health of mothers [17]. The cultural and

demographic aspects of maternal health also add another level of complexity to the conversation. The spectrum of maternal problems in C-section births is influenced by differences in healthcare access, socioeconomic circumstances, and cultural traditions [18]. Designing evidence-based healthcare policies that are also attentive to the demands and problems encountered by varied populations requires acknowledging these diversities.

This systematic review aims to provide an in-depth understanding of maternal complications related to Cesarean sections by critically analysing research and synthesising data from the existing literature. To ensure the health of mothers and newborns, we hope to clear the path for informed decision-making in the field of maternal healthcare through the promotion of knowledge and insights.

Materials and Methods:

Literature search: Our investigation into the existing literature was all-encompassing, spanning a vast array of databases such as EMBASE, PubMed, and WOS (Web of Sciences). By searching these diverse resources, our goal is to mitigate the potential influence of publication bias and encompass a wide spectrum of pertinent studies.

Keyword Selection and Search Terms: Crafting a precise search strategy involved the utilization of a blend of controlled vocabulary terms (e.g., MeSH terms) and free-text keywords. The primary search terms included "Cesarean section," "complications," and "maternal complications." These terms were interconnected using Boolean operators and refined through the incorporation of synonyms and related expressions. An experienced medical librarian collaborated in devising this search strategy, ensuring its heightened sensitivity and specificity.

Criteria for Study Inclusion: The inclusion criteria mandated the consideration of studies published post the year 2000. To uphold the dependability and credibility of the literature selection process, a preliminary screening, or pilot literature review, was meticulously conducted. This preliminary screening involved two independent researchers, with any disparities resolved by a third reviewer. Each study's title and abstract underwent thorough scrutiny to ascertain its relevance to the research objectives. Subsequently, the full text of identified papers was obtained and meticulously examined to extract the pertinent outcome estimates reported in each study. This rigorous approach aimed to maintain a methodologically sound and accurate foundation throughout the data collection process, ensuring a robust basis for the subsequent analysis and synthesis of findings.

Inclusion Criteria: The systematic review adhered to explicit inclusion and exclusion criteria to govern the selection of studies. Included studies met specific criteria: they were original research studies, encompassing randomized controlled trials (RCTs), observational studies (cohort, case-control), and systematic reviews/meta-analyses, and were published in English.

Exclusion Criteria: Studies failing to meet these criteria or exhibiting low methodological quality were excluded. Additionally, case reports, editorials, letters, and animal studies were excluded from consideration.

Study Screening and Selection Procedure: The study selection process followed a two-stage screening protocol. Initially, two independent reviewers evaluated titles and abstracts of retrieved articles against predefined inclusion and exclusion criteria. Subsequently, the full-text articles of potentially suitable studies underwent a thorough assessment by the same reviewers. Any disparities or disagreements between the reviewers were resolved through discussion or consultation with a third reviewer if needed.

Extraction of Data: A standardized form for data extraction was devised to systematically gather pertinent information from the selected studies. The extracted data covered various aspects:

1. Study particulars: Title, authors, publication year.
2. Patient attributes: Age, sample size, and inclusion/exclusion criteria.
3. Outcome metrics: Maternal complications following Cesarean section.

Assessment Tools for Quality:

The quality of the included studies underwent evaluation using specific tools tailored to their respective designs. The Cochrane Risk of Bias tool [19] was applied to assess biases in various domains for randomized controlled trials (RCTs), including random sequence generation, allocation concealment, blinding, and attrition. Non-randomized studies were evaluated using tools such as the Newcastle-Ottawa Scale for cohort and case-control studies [20]. Systematic reviews and meta-analyses underwent quality assessment through the AMSTAR-2 tool [21]. The studies included for analysis are illustrated in Figure 1.

Data Integration:

The data synthesis involved creating a narrative summary encompassing study characteristics, outcomes, and findings. This analysis aims to provide a qualitative assessment of postoperative complications associated with congenital cardiac surgeries.

Ethical Considerations:

Adherence to ethical guidelines and principles in alignment with international research standards was a cornerstone of this study. No individual patient data were collected, relying solely on aggregated data from previously published studies. Ethical approval was not deemed necessary for this systematic review as it did not involve direct

interaction with human subjects or the initiation of new research.

Reporting Guidelines:

This systematic review conformed to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, ensuring transparent and comprehensive reporting [22].

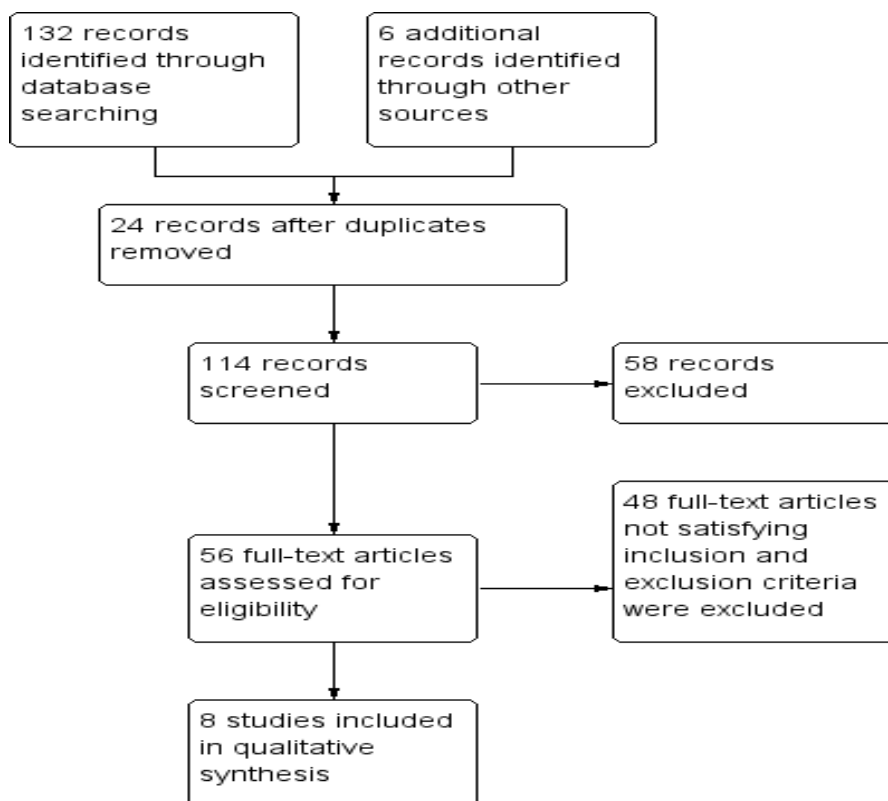


Figure 1: PRISMA study selection flow-chart

Result: Table 1 illustrates the characteristics of the included studies. Eight studies were included in this systematic review. Six of them were of cohort study design, one each were of case-control and cross-sectional study designs. The studies included were from different places from India to United States and Italy. Sample size ranges from 5779 [28] to 286565 [25].

Table 1: Characteristics of included studies

Author	Study design	Place	Sample size	Results
Kamilya et al. 2010 [23]	Cohort	India	43842	Women undergoing Cesarean section had a higher chance of death (OR = 3.01).
Farchi et al. 2010 [24]	Cohort	Italy	273789	Women undergoing Cesarean section had a higher chance of hysterectomy (OR = 1.30), obstetric shock (OR = 2.15), and complications of anesthesia (OR = 2.18).
Souza et al. 2010 [25]	Cross sectional	Multicentric done in 24 countries	286565	Women undergoing Cesarean section present with a higher risk of death than women with spontaneous vaginal delivery (OR = 3.21), but they had a greater chance of admission to an intensive care unit (ICU) (OR = 58.85), blood transfusion (OR = 2.24), hysterectomy (OR = 13.53).
Declercq et al. 2007 [26]	Cohort	United States	244088	Women undergoing Cesarean section had a 2.25 times greater chance of rehospitalization in the first 30 days

				after delivery compared to women with vaginal delivery.
Deneux-Tharaux et al. 2006 [27]	Case control	France	10309	Women with Cesarean section presented (RR = 3.64) times more chance of death.
Allen et al. 2006 [28]	Cohort	Canada	5779	The women of the Cesarean group had a lower chance of postpartum hemorrhage (RR = 0.61).
Koroukian et al. 2004 [29]	Cohort	United States	168736	Women undergoing Cesarean section had higher risk of puerperal infection (RR = 3.75), thromboembolic events (RR = 3.45), anesthetic complications (RR = 4.43), and complications of surgical wound (RR = 12.50) and they presented a lower risk of postpartum hemorrhage (RR = 0.60) and obstetric trauma (RR = 0.16).
Allen et al. 2003 [30]	Cohort	Canada	18435	Women with Cesarean section had a higher risk of puerperal infection (RR = 5.4) and surgical wound infection (RR = 3.5).

Postpartum Infection: Studies evaluating postpartum infection [24, 28, 29, 30] yielded mixed results. While one study found no association between delivery type and infection (OR = 1.46, 95%CI 0.89–2.40), others reported a higher risk of puerperal infection (RR = 3.75, 95%CI 3.12–4.51) and surgical wound complications (RR = 12.50, 95%CI 10.00–15.63) for women undergoing cesarean section compared to vaginal delivery.

Another study indicated increased risk for puerperal infection (RR = 5.4, 95%CI 2.4–11.8) and surgical wound infection (RR = 3.5, 95%CI 1.8–6.7) in cesarean sections before labor.

Hemorrhage: Findings regarding postpartum hemorrhage were contentious across six studies. Two studies [26, 28] reported a lower risk of postpartum hemorrhage for women with cesarean section (RR = 0.60; 95%CI 0.48–0.76 and RR = 0.61, 95%CI 0.42–0.88), while another study found no association between delivery type and hemorrhage or blood transfusion [30].

The chance of blood transfusion was higher for women undergoing cesarean section after labor (OR = 2.24, 95%CI 2.24–6.1), and intrapartum cesarean section correlated with a higher chance of hysterectomy (OR = 13.53, 95%CI 4.79–38.2) [28].

Hospitalization: In a WHO study spanning 24 countries, cesarean section correlated with increased likelihood of ICU admission (intrapartum OR = 58.85, 95%CI 41.46–83.52; antepartum OR = 30.75, 95%CI 18.12–52.17). Primary cesarean section without labor also led to a 2.25 times greater chance of rehospitalisation within 30 days post-delivery (95%CI 1.74–2.90) compared to vaginal delivery [25].

Obstetric Trauma: A single study on obstetric trauma revealed that women with vaginal deliveries were more likely to experience perineal and vaginal lacerations, pelvic organ damage, and damage to

pelvic joints and ligaments compared to those undergoing cesarean section (RR = 0.09, 95%CI 0.07–0.11) [29].

Maternal Death: Studies [23, 25, 27] examining maternal death reported divergent findings. One study found no relation between delivery type and death, while others identified a greater chance of death for women undergoing cesarean section. Cases of maternal death were more likely in cesarean sections than controls (OR = 3.64, 95%CI 2.15–6.19).

The chance of death was 3.11 times higher (95%CI 1.58–6.10) for antepartum and 4.35 times higher (95%CI 2.23–8.45) for intrapartum cesarean section. Another study revealed a 3.01 times higher death rate for women with cesarean section compared to vaginal delivery (95%CI 1.66–5.46), rising to 4.86 times higher (95%CI 2.47–9.56) for intrapartum cesarean section, but no association for antepartum cesarean section (OR = 1.73, 95%CI 0.80–3.71).

Discussion

The results section's comprehensive examination of maternal problems after Cesarean sections invites a thoughtful discussion of the disparate outcomes from eight different studies with different designs and geographic coverage.

A complicated landscape is shown by analysing research on postpartum infection [24, 28, 29, 30]. Even though there are differences, some studies indicate that women who choose to have Cesarean sections have a higher risk of puerperal infection (RR = 3.75, 95%CI 3.12–4.51) and surgical wound complications (RR = 12.50, 95%CI 10.00–15.63) than women who do not (OR = 1.46, 95%CI 0.89–2.40).

A second study highlights the higher risk of infection associated with prelabour Cesarean sections (RR = 5.4, 95%CI 2.4–11.8). Because of

this contradiction, it is important to carefully evaluate the variables that affect infection rates, such as surgical methods, preoperative circumstances, and postoperative care. Six researches on postpartum haemorrhage reveal inconsistent results. Women having Cesarean sections may be at lower risk, according to two research [26, 28], whereas a third study [30] finds no link between haemorrhage or blood transfusion. Hemorrhagic outcomes are determined by a complex interplay of surgical techniques, obstetric practices, and patient-specific variables. Interestingly, there is a significant increase in the risk of blood transfusion after Cesarean section during labour (OR = 2.24, 95%CI 2.24–6.1), highlighting the significance of careful postoperative monitoring and management.

Results from a 24-country World Health Organisation (WHO) research highlight the association between higher ICU admission rates and Cesarean sections (intrapartum OR = 58.85, 95%CI 41.46–83.52; antepartum OR = 30.75, 95%CI 18.12–52.17).

Moreover, the chance of rehospitalization within 30 days after birth is 2.25 times higher for primary Cesarean sections performed without labour (95%CI 1.74–2.90). These results call for a thorough assessment of the necessity and appropriateness of Cesarean births, considering any potential problems and the ensuing need for resources for critical care.

The only research on obstetric trauma highlights those women having Cesarean sections had a decreased risk (RR = 0.09, 95%CI 0.07–0.11). This conclusion highlights the value of individualised obstetric treatment by prompting a rigorous analysis of the trade-off between the possible trauma linked to vaginal births and the safety offered by Cesarean sections.

A complicated link is revealed by the divergent findings in research assessing maternal death [23, 25, 27]. An increased risk of maternal mortality following Cesarean sections is shown by several studies, however one finds no discernible correlation. The significance of this result is shown by the higher risk of Cesarean sections in comparison to controls (OR = 3.64, 95%CI 2.15–6.19).

In addition, differences are found between antepartum and intrapartum Cesarean sections; the latter have much greater fatality rates (OR = 4.35, 95%CI 2.23–8.45). Clinical decision-making requires careful assessment of the complex interactions between several factors that influence maternal mortality, such as prior diseases, surgical urgency, and postoperative care.

The combined data emphasises how complicated the mother problems from Cesarean procedures may be. The conversation emphasises the significance of customised and knowledgeable decision-making that considers a wide range of variables affecting results. To improve mother care and tailor delivery strategies to the unique needs and circumstances of each patient, further research and ongoing assessment of obstetric practices are essential notwithstanding the thorough investigation of maternal problems after Cesarean sections, a number of limitations should be taken into account. The possibility for confounding factors is introduced by the inherent heterogeneity in study designs and geographic locations, which restricts the generalizability of findings. Complexity is increased by heterogeneity in surgical methods, postoperative care, and clinical procedures among various locales. Differences in sample sizes across the included research might affect how reliable results are. Furthermore, recollection and information bias may be introduced by the retrospective character of certain research and the reliance on reported results.

Conclusion

The intricacy of making decisions in obstetric care is highlighted by a range of consequences, from infection risks to maternal death. The study presents contradictory results, highlighting the necessity of tailored strategies. Notwithstanding its limits, this study encourages contemplation on the multifaceted character of results and calls for ongoing assessment of clinical procedures. With the help of this thorough study, medical professionals may improve their strategy by weighing the advantages and disadvantages and maximising mother wellbeing in a variety of obstetric situations.

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