Review Article

Does Mode of Delivery Affect the Incidence of Pelvic Organ Prolapse? A Systematic Review

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ABSTRACT

The study aim is to analyze research on the link between delivery mode and pelvic organ prolapse (POP). A thorough search across four databases identified 416 relevant publications. After removing duplicates using Rayyan QCRI and screening for relevance, the search yielded 193 publications, of which 78 full-text articles were reviewed, and 6 met the eligibility criteria for evidence synthesis. This review analyzed six studies encompassing 11,790 women. The prevalence of POP varied widely, from 3.5% to 51.3%. Across all studies comparing vaginal and cesarean deliveries, vaginal birth consistently demonstrated a higher association with POP, reinforcing its role as a significant risk factor. Vaginal delivery was associated with increased pelvic muscle strain and tearing, contributing to prolapse, while cesarean section (CS) provided some protection against advanced-stage POP postpartum. However, cesarean birth was also linked to potential long-term pelvic muscle dysfunction. Vaginal delivery was identified as a major risk factor for anterior vaginal wall prolapse, with additional contributors including sphincter damage, perineal tears, prolonged labor, and assisted delivery. This review highlights vaginal delivery as a major risk factor for POP, while cesarean section appears to offer some protective benefits. However, due to the potential risks of cesarean birth, a balanced approach to delivery planning is essential. Future research should investigate long-term pelvic floor outcomes and preventive measures to reduce prolapse risk while ensuring maternal and neonatal well-being. Clinicians should incorporate these insights into patient counseling and postpartum care to promote better pelvic health.

Keyword: Pelvic organ prolapse; Mode of delivery; Cesarean section; Vaginal delivery; Systematic review.

Introduction

The mode of delivery is a critical factor in maternal health, influencing not only the immediate postpartum recovery but also long-term outcomes such as POP. POP, a condition in which the pelvic organs such as the bladder, uterus, or rectum descend into the vaginal canal due to weakened support structures, poses significant health challenges to women, affecting their quality of life and resulting in various psychosocial issues [1].

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POP occurs when the pelvic floor muscles and connective tissues become weakened or damaged, leading to a loss of support for pelvic organs. Its symptoms can range from mild pelvic pressure to severe discomfort, including urinary incontinence, fecal incontinence, and the sensation of a bulge in the vagina. Although it may not be life-threatening, POP can significantly impair a woman's physical, emotional, and social well-being [2]. The risk factors for POP are multifaceted, including age, genetic predisposition, hormonal changes, and lifestyle factors such as obesity and chronic cough. However, one of the most significant modifiable risk factors is the mode of delivery during childbirth [3]. Vaginal delivery has been associated with higher incidences of POP compared to cesarean delivery. Several factors contribute to this increased risk. During vaginal delivery, the pelvic floor muscles and connective tissues are subjected to significant mechanical stress as the baby descends through the birth canal. This trauma can lead to muscle stretching, tearing, or even avulsion of pelvic support structures, especially in cases of prolonged labor or instrumental deliveries involving forceps or vacuum extraction [4]. Studies have indicated that women who have experienced vaginal deliveries may have a two to three times higher risk of developing POP later in life compared to those who have had cesarean deliveries. This is particularly evident in multiparous women - those who have given birth multiple times - as the cumulative effects of repeated vaginal births exacerbate pelvic floor weakness [5]. Furthermore, certain obstetric factors during vaginal delivery, such as the size of the baby and the length of the second stage of labor, have also been associated with increased risk for POP. Larger babies may increase the likelihood of perineal trauma, while prolonged labor can lead to greater pelvic floor stress [2]. Cesarean delivery, particularly elective cesareans, has been suggested to have a protective effect against the development of POP. Since this mode of delivery avoids the stretching and potential damage to pelvic support structures that occurs during vaginal birth, women who deliver via cesarean may experience a lower incidence of POP. However, it is crucial to clarify that while cesareans potentially reduce the risk of pelvic floor injury during birth, they are not exempt from other pregnancy-related complications that may indirectly contribute to POP [5]. Moreover, some studies have indicated that women who deliver by cesarean section may still face risks associated with pelvic floor dysfunction. For instance, cesarean deliveries performed after a prior vaginal birth do not completely mitigate the risk of POP derived from previous vaginal deliveries. Additionally, there is evidence that cesarean sections may be associated with increased rates of certain pelvic floor disorders, such as urinary incontinence, due to factors such as surgical trauma or postoperative complications [6]. While the mode of delivery is a critical determinant of pelvic floor health, it is essential to consider other influencing factors that may confound the relationship between delivery mode and POP. Age is a significant risk factor for POP; as women age, the integrity of pelvic support structures diminishes, regardless of the delivery method. Moreover, differences in socioeconomic status, access to healthcare, and lifestyle choices also play pivotal roles in the manifestation of POP [7]. Advancements in obstetric practices, including better prenatal care and postnatal rehabilitation programs, are crucial in mitigating the risk of POP regardless of delivery mode. These may include pelvic floor exercises, physiotherapy, and education on proper body mechanics, which aim to strengthen pelvic support muscle [2, 7]. POP is a prevalent condition affecting women, particularly those who have undergone childbirth. The mode of delivery - vaginal versus cesarean section - has been posited as a potential risk factor influencing the development of POP. Understanding the relationship between delivery mode and POP incidence is crucial for guiding clinical practices, informing patient counseling, and improving health outcomes. The incidence of POP in women post-delivery raises important questions regarding the safety and long-term implications of various delivery methods. Despite anecdotal and preliminary evidence suggesting a connection between mode of delivery and subsequent POP, existing studies show conflicting results. This inconsistency necessitates a thorough examination of the evidence in order to understand the causal relationship, if any, between delivery methods and pelvic floor disorders. The aim of this systematic review is to critically analyze and synthesize existing research on the relationship between mode of delivery and the incidence of POP among women to clarify the impact of various delivery methods on pelvic health, ultimately informing clinical decision-making processes.

Methods

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [8] guidelines to rigorously evaluate the impact of delivery mode on the incidence

of POP. The primary objective was to systematically assess the relationship between the mode of delivery - specifically vaginal versus cesarean delivery - and the occurrence of POP among women. To achieve this, a thorough electronic literature search was performed across multiple databases, including PubMed, Web of Science, SCOPUS, and Science Direct. The search aimed to identify articles published in English that investigated the correlation between delivery mode and POP. Key search terms encompassed "mode of delivery," "pelvic organ prolapse," "vaginal birth," and "cesarean section." Two independent reviewers screened the identified studies, ensuring they met the predetermined inclusion and exclusion criteria. Subsequently, relevant data were extracted, and the quality of the selected studies was appraised utilizing recognized assessment techniques.

Eligibility Criteria: Inclusion criteria: Studies considered for inclusion had to evaluate the effects of the mode of delivery on the incidence of POP, offering insights into prevalence rates, risk factors, and associated clinical outcomes. Only peer-reviewed articles published in English within the last five years were considered to ensure the review reflected the most current research. The review included randomized controlled trials, cohort studies, and case-control studies to encompass a diverse spectrum of available evidence.

Exclusion criteria: Studies that did not focus on the relationship between delivery mode and POP were excluded. This included research that solely addressed either delivery methods or prolapse without establishing their connection. Additionally, literature focusing on pediatric populations, non-peer-reviewed materials, or studies lacking specific data linking mode of delivery to POP outcomes were omitted from the review.

Data Extraction: Rayyan (QCRI) [9] was utilized to manage and assess the results from our literature search, enhancing the reliability of our findings. The titles and abstracts extracted from our comprehensive search were screened for pertinence based on the predetermined inclusion and exclusion criteria. The research team conducted an in-depth review of studies that met these criteria, resolving any discrepancies through consensus discussions. A pre-established data extraction template was employed to gather essential information, including the titles, authors, publication dates, geographical locations, participant demographics, gender ratios, as well as epidemiological data and risk factors connected to the mode of delivery and POP incidence. Additionally, a tool was created to evaluate the potential risk of bias in the studies selected for this review.

Data Synthesis Strategy: The data obtained from relevant studies were compiled to produce summary tables that facilitated a qualitative assessment of the research outcomes and key components. After completing the data collection for the systematic review, the most effective strategies for analyzing and presenting the information from the included studies were determined.

Risk of Bias Assessment: We applied the Joanna Briggs Institute (JBI) [10] critical appraisal tool for quality assessment of the research. This assessment consisted of nine questions designed to evaluate the methodological rigor of the studies. Each positive response received a score of 1, while negative, unclear, or irrelevant responses were scored as 0. A cumulative score of eight or above indicated high quality, a score between five and seven suggested moderate quality, and a score of less than four indicated low quality. The quality of each study was evaluated independently by members of the research team, and discrepancies were reconciled through discussion.

Results

The specified search strategy yielded 416 publications (Figure 1). After removing duplicates (n = 223), 193 articles were evaluated based on title and abstract. Of these, 111 failed to satisfy eligibility criteria, leaving just 82 full-text articles for comprehensive review. A total of 6 satisfied the requirements for eligibility with evidence synthesis for analysis. Sociodemographic and clinical outcomes: We included 6 studies with a total of 11,790 women. Three studies were case controls [13, 15, 16], one was a randomized control trial (RCT) [11], one was a cross-sectional study [12], and one was a retrospective cohort [14]. Three studies were implemented in China [12, 14, 16], one in the USA [11], one in Congo [13], and one in Ethiopia [15]. The prevalence of POP ranged from 3.5% [12] to 51.3% [16]. The comparison of POP incidence between vaginal delivery and CS across the included studies highlights a clear trend favoring cesarean delivery as a protective factor against POP. In studies where both vaginal and cesarean deliveries were assessed, the percentage of women experiencing POP was consistently higher among those who had undergone vaginal delivery [11-16]. One study suggested that vaginal delivery may pose a risk factor for POP due to the potential for tension or tears in the pelvic muscles and connective tissue. At six months postpartum, cesarean delivery was associated with protection against stage 2 or higher POP [11]. Another

study found that, in comparison to vaginal delivery, cesarean delivery was linked to a higher incidence of aberrant resting muscular strength, which may have implications for long-term pelvic health [12]. Further research reinforced the association between vaginal delivery and a greater likelihood of developing POP. One study highlighted that vaginal delivery was significantly associated with the occurrence of POP, emphasizing its role as a major contributing factor [13]. Additionally, an investigation into risk factors revealed that vaginal birth was a significant predictor of anterior vaginal wall prolapse, with statistical evidence supporting this relationship ($p < 0.05$) [14]. Several studies also explored the specific physiological effects linked to different modes of delivery. One analysis identified risk factors such as sphincter damage, vaginal tears, extended labor, and assisted vaginal delivery as critical contributors to POP [15]. Another study compared the effects of vaginal and cesarean deliveries on pelvic floor function within 6–8 weeks postpartum, concluding that vaginal delivery had a significantly greater impact. The findings suggested that selective CS provided considerable protection to the pelvic floor tissues [16].

Discussion

The findings from the included studies reinforce the well-established association between vaginal delivery and an increased risk of POP. The higher incidence of POP in women who underwent vaginal delivery, as compared to those who had a cesarean section, suggests that mechanical strain on the pelvic floor during labor plays a crucial role in the pathogenesis of POP. Factors such as perineal trauma, prolonged labor, and sphincter damage likely contribute to the weakening of pelvic support structures, predisposing women to prolapse in later years. The studies that reported CS as a protective factor against POP align with previous literature indicating that the avoidance of vaginal delivery reduces the likelihood of major pelvic floor dysfunction. Leng *et al.* [17] results reinforce the significant association between vaginal birth and the development of POP, highlighting the first vaginal delivery as a major contributing factor. Additionally, forceps-assisted delivery further increases the risk, suggesting that mechanical stress during labor plays a crucial role in pelvic floor weakening. In contrast, exclusive cesarean delivery appears to provide a protective effect against prolapse without introducing additional risks when compared to women who have never given birth. These findings underscore the importance of considering delivery mode as a key factor in pelvic health and the potential benefits of targeted preventive strategies for at-risk women. According to a meta-analysis by Keag *et al.* [18], compared to vaginal delivery, cesarean delivery is linked to a lower incidence of POP and urine incontinence. Schulten *et al.* [19] also reported that smoking and cesarean delivery are important preventative measures against primary POP. Loss of the support and suspension that the endopelvic fascia and pelvic floor muscles - particularly the levator ani muscle components -. provide leads to pelvic floor dysfunction. Numerous researches had asserted that vaginal birth might harm these structures directly and the pelvic floor nerves indirectly [20, 21]. The levator ani muscle's weakening overpowers the uterosacral and parametrial ligaments as well as the endopelvic fascia, resulting in secondary injuries to these tissues, and the pelvic muscular tonus reduces with nerve damage [22, 23]. During vaginal childbirth, the descent of the baby’s head places substantial pressure on the pelvic floor muscles and surrounding connective tissues, resulting in considerable distortion [24, 25]. The weakening of pelvic muscle resilience following delivery can be evaluated using various assessment methods, including standardized clinical examinations, vaginal cone testing, intravaginal pressure monitoring, and translabial ultrasonography [26, 27]. A study by Nielsen *et al.* [28] reported that pelvic muscle strength did not fully regenerate until approximately eight months postpartum, with 34% of participants still unable to voluntarily engage their pelvic muscles six weeks after childbirth. Among the pelvic floor components, the puborectalis muscle and the central segment of the pubococcygeus undergo the most extensive elongation during fetal expulsion, stretching over three times more than other pelvic muscles. This extreme extension exceeds by 217% the maximum stretch threshold observed in the musculature of non-pregnant mammals without causing fiber rupture [29]. Notably, detachment of the puborectalis muscle significantly impairs pelvic floor muscle integrity, further diminishing support and functional capacity [27]. The findings of this review have important clinical implications for obstetricians, gynecologists, and midwives. Given the strong correlation between vaginal delivery and POP, clinicians should engage in shared decision-making with expectant mothers, particularly those at high risk for pelvic floor disorders, such as women with a history of prolonged labor, instrumental delivery, or multiple vaginal births.

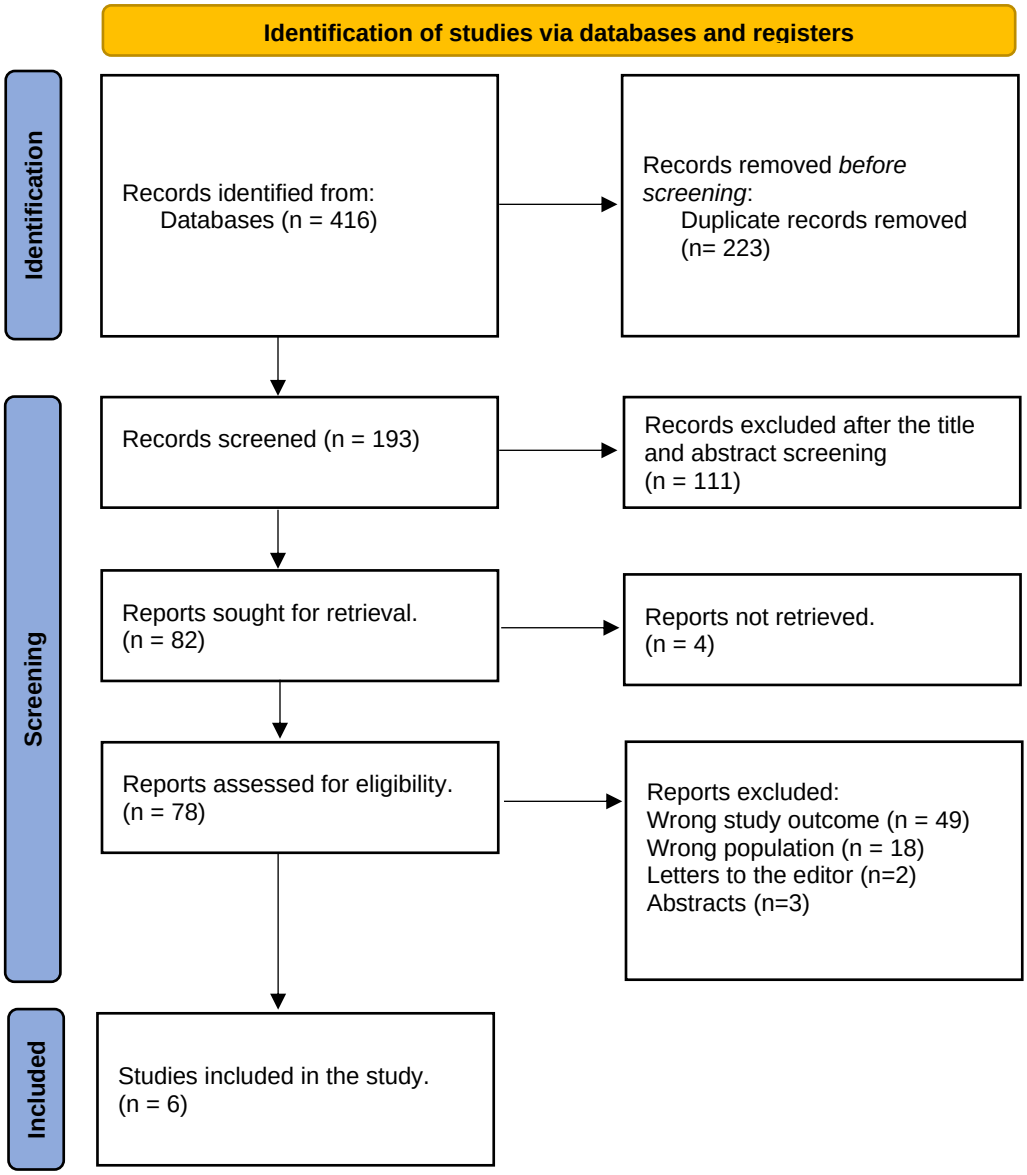

Figure 1: PRISMA flowchart [8].

Table 1: Outcome measures of the included studies.

Study ID	Country	Study design	Sociodemographic	POP (%)	POP in VD (%)	POP in CS (%)	Main outcomes
Saucedo et al., 2022 [11]	USA	RCT	Cases: 793 Mean age: 27.8	91 (11.5%)	NM	NM	There may be a risk factor during the actual vaginal delivery procedure, possibly due to the resulting tension or tears on the pelvic muscles and connective tissue. At six months, Cesarean delivery was linked to protection against stage 2 or higher POP.
Gao et al., 2024 [12]	China	Cross-sectional	Cases: 845 Mean age: 29.3	30 (3.5%)	25 (83.33)	5 (16.6%)	Compared to vaginal delivery, cesarean delivery was linked to greater incidences of aberrant resting muscular strength.

Kayembe et al., 2024 [13]	Congo	Case-control	Cases: 134 Mean age: 30-79	NM	128 (95.5%)	NM	Factors associated with the occurrence of POP includes vaginal delivery.
Li et al., 2024 [14]	China	Retrospective cohort	Cases: 9569 Mean age: 24.8	3481 (36.4%)	1994 (57.3%)	1487 (52.7%)	Vaginal birth was one of the significant risk variables linked to the development of anterior vaginal wall prolapse ($p < 0.05$).
Borsamo et al., 2023 [15]	Ethiopia	Case-control	Cases: 369	123 (33.3%)	119 (96.7%)	4 (3.3%)	Significant risk factors for POP were sphincter damage/vaginal tear, extended labor, and assisted vaginal delivery.
Wang et al., 2022 [16]	China	Case-control	Cases: 80 Mean age: 24.3	41 (51.3%)	25 (61%)	16 (39%)	Compared to selective cesarean section, vaginal delivery had a much greater impact on pelvic floor

							function 6–8 weeks postpartum. The pelvic floor tissue of the mother was protected to a considerable extent via selective cesarean section.

Preventive strategies should be incorporated into prenatal care, including pelvic floor muscle training and education on labor techniques that minimize perineal trauma. Additionally, postpartum pelvic floor rehabilitation should be encouraged, particularly for women who experience significant perineal trauma or symptoms of prolapse following vaginal birth. While elective CS may reduce the risk of POP, it should only be recommended after considering the overall maternal and neonatal risks associated with surgical delivery. Strengths and limitations: One of the primary strengths of this review is the inclusion of diverse study designs, such as randomized controlled trials, cohort studies, and case-control studies, which enhance the robustness of the findings. The use of standardized critical appraisal tools also ensured the methodological quality of the included studies. However, several limitations must be acknowledged. First, variability in study populations, follow-up durations, and diagnostic criteria for POP may introduce heterogeneity, affecting the generalizability of the results. Second, while cesarean delivery appears to be protective against POP, the long-term effects on pelvic floor function were not consistently assessed across studies. Additionally, some studies lacked detailed information on confounding factors such as parity, body mass index, and obstetric interventions, which could influence POP risk.

Conclusion

This systematic review provides compelling evidence that vaginal delivery is a significant risk factor for POP, whereas CS offers a degree of protection against its development. However, given the potential risks associated with cesarean delivery, a balanced approach to delivery mode selection is necessary. Future research should focus on long-term pelvic floor outcomes following different delivery modes and explore preventive interventions that mitigate the risk of POP while preserving maternal and neonatal health. Clinicians should integrate these findings into patient counseling and postpartum care strategies to optimize pelvic health outcomes for women.

Conflict of Interest

None

Funding

None

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