

Post-cesarean versus primary bladder endometriosis and coexistent pelvic endometriosis: a systematic review

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Systematic Review**Title: Post-cesarean versus primary bladder endometriosis and coexistent pelvic endometriosis: a systematic review****Author List:**

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Obstetricia et Gynecologica Scandinavica; has received royalties from Wolters Kluwer for chapters on endometriosis management in the clinical decision support resource UpToDate; and maintains both a public and private gynecologic practice. P. Vi. is the Co-Editor-in-Chief of the *Journal of Endometriosis and Uterine Disorders*. E.S. is Editor-in-Chief of *Human Reproduction Open*; discloses payments from Ferring for research grants; and honoraria from Institut Biochimique Société Anonyme (IBSA) and Gedeon-Richter for lectures, and maintains both a public and private gynecologic practice. No other disclosures were reported.

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Précis

Post-cesarean bladder endometriosis is associated with a lower prevalence of coexisting lesions than primary forms, pointing to peritoneal injury combined with endometrial dissemination as pathogenic determinants even in nonpredisposed women.

Abstract

Objective: To investigate the prevalence of coexisting pelvic lesions in post-cesarean bladder endometriosis (BE) and primary BE. If women with post-cesarean BE exhibit a lower prevalence of coexistent endometriosis, it could be hypothesized that peritoneal damage of the vesicouterine fold, coupled with surgical dissemination of decidual fragments may be sufficient *per se* for lesion development.

Data Sources: Systematic search conducted in PubMed, Embase, and Scopus up to March 20th, 2025.

Methods of Study Selection: Eligibility was defined using the PICOS framework: women with post-cesarean BE (Population); full pelvic assessment with surgical or imaging-based confirmation of endometriosis (Intervention); women with primary BE and no prior cesarean section (CS) (Comparator); presence of endometriosis beyond the bladder (Outcome); and case reports or series providing sufficient clinical/surgical details (Study type). Studies were evaluated using the Joanna Briggs Institute Critical Appraisal Checklists. The review followed PRISMA 2020 guidelines. No formal analysis was performed due to the descriptive nature of the data, but crude proportions were compared using Fisher's exact test.

Tabulation, Integration, and Results: Of 7,378 records identified, 4,499 were screened and 374 full texts assessed. Eighty-one studies were included, accounting for 117 women with BE (26 post-cesarean, 91 primary). Coexistent pelvic endometriosis was significantly less frequent in post-cesarean BE (19.2%) than primary BE (79.1%) ($p < 0.0001$). The odds of concomitant pelvic endometriosis were approximately 16 times lower in post-cesarean BE compared to primary BE (OR 0.06; 95% Confidence Interval, 0.02-0.20). In the limited number of post-cesarean cases with coexistent pelvic endometriosis, lesions were restricted to few 2021 #Enzian compartments.

Conclusion: Peritoneal injury followed by iatrogenic dissemination of endometrial fragments during CS may be sufficient *per se* to cause BE, regardless of individual predisposition. Therefore,

adopting surgical techniques that potentially reduce the risk of this long-term post-cesarean complication should be recommended.

Introduction

Urinary tract endometriosis (UTE) represents a rare localization of endometriosis, affecting 0.3–12% of individuals with the disease [1]. Bladder endometriosis (BE) is the most frequent form, comprising 70–85% of UTE cases and typically involving the posterior wall and dome [2].

According to the international working group of the American Association of Gynecologic Laparoscopists (AAGL), the European Society for Gynaecological Endoscopy (ESGE), the European Society of Human Reproduction and Embryology (ESHRE) and the World Endometriosis Society (WES), BE is defined by the presence of endometriosis infiltrating the detrusor muscle and/or the bladder epithelium [3].

Based on its onset, BE is usually categorized into two forms: primary, which arises spontaneously in the absence of prior pelvic surgery, and secondary, which develops following pelvic surgery, most commonly cesarean section (CS) [4].

Primary BE is thought to result from the implantation of refluxed endometrial cells in the anterior cul-de-sac under the influence of gravity [5,6]. The absence of BE in women with a retroverted uterus, lacking the anterior cul-de-sac, and the preferential location of BE on the posterior bladder wall or dome, i.e., above the uterine isthmus, supports this theory [5,7,8].

In contrast, secondary BE following CS is assumed to result from discontinuation of the peritoneum of the vesicouterine fold, followed by iatrogenic dissemination of decidual fragments during obstetrical maneuvers after lower uterine segment incision [4]. The combination of disruption of the mesothelial barrier, denudation of the subperitoneal mesenchymal tissues, and decidual fragments displacement may create a favorable environment for the implantation and proliferation of endometrial cells, ultimately leading to the development of BE lesions.

We conducted a systematic review of the literature to investigate the prevalence of coexisting pelvic lesions in post-cesarean BE and primary BE. If women with post-cesarean BE exhibit a lower prevalence of coexistent pelvic endometriosis compared to those with primary BE, this would suggest that mechanical factors such as peritoneal discontinuation followed by iatrogenic dissemination may be sufficient *per se* to cause lesion development. Conversely, if both groups show a comparable prevalence of associated pelvic lesions, a predisposing background may be required for BE to establish, regardless of surgical history.

Beyond pathogenetic implications, if the proposed hypothesis holds true, the findings of this systematic review may highlight the role of surgical techniques in causing (or preventing) secondary BE—an aspect that, in the context of globally rising CS rates [9] could be of public health relevance.

Methods

Study Design and Search Strategy

The study protocol was registered on PROSPERO (Registration ID Number CRD420251014847; registered on March 19th, 2025). The systematic review was performed following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [10] (**Supplemental Appendix 1**).

Two independent reviewers (A.R., C.B.) conducted a comprehensive search of PubMed, Embase and Scopus, which was last updated on March 20th, 2025. The search strategy was based on a combination of Medical Subject Headings (MeSH) terms and corresponding keywords (**Supplemental Appendix 2**).

Eligibility Criteria

Inclusion criteria were defined using the PICOS framework [11]: 1) Population: women with secondary BE occurring after CS. The diagnosis of BE was confirmed either by surgery with histological confirmation or by biopsy of the nodule in cases managed non-surgically; cases based

solely on medical records or self-reported history (i.e., mentioned only as part of the patient's medical history) were excluded; 2) Intervention: comprehensive pelvic assessment to determine the presence or absence of coexistent pelvic endometriosis. The coexistence of pelvic endometriosis with BE had to be confirmed by surgical exploration or imaging for deep or ovarian endometriosis; cases involving the external uterine wall noted during surgery were also included. Absence of concomitant disease was considered reliable only when confirmed through direct surgical visualization of the pelvic cavity, in order to minimize the risk of type II error (false negative due to failure to report coexistent pelvic endometriosis when it was present); 3) Comparison: women with primary BE and no history of CS; 4) Outcomes: Presence of coexistent pelvic endometriosis beyond the bladder identified by surgical visualization; 5) Study type: case reports or case series providing sufficient detail to confirm or rule out the outcome.

Studies were excluded if parity and mode of delivery (vaginal or CS) were not reported. Additional exclusion criteria were: i) cases of UTE without bladder involvement; ii) cases in which the described lesions were localized solely on the peritoneal surface of the bladder (utero-vesical fold peritoneum), with no infiltration of the detrusor muscle (classified as peritoneal endometriosis according to guidelines [3]); iii) cases in which the absence of extravesical endometriosis could not be confirmed due to lack of surgical pelvic evaluation; iv) cases where surgical inspection revealed ovarian cysts without visible features of endometriosis and no histological analysis of the cyst content; and v) cases of postmenopausal BE, in which the presence of prior endometriosis could not be reliably assessed or ruled out.

Study selection and data extraction

Records were independently screened by two reviewers (A.R., C.B.), with discrepancies resolved through discussion with a third reviewer (N.S.). A list of extracted variables is provided in

Supplemental Appendix 3.

Quality assessment

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists, applying the appropriate version for each study type [12,13]. For case reports, the CARE guidelines (for CAse REports) informed interpretation of JBI criteria [14]. Studies were considered eligible if they received a majority of positive responses.

Quality assessment was performed by two reviewers (A.R., C.B.), with discrepancies resolved by a third reviewer (N.S.).

Data analysis

Given that data were derived from case reports and case series, no formal meta-analysis was conducted. Clinically relevant traits were summarized through descriptive statistics (counts and proportions) for women with post-cesarean and primary BE. No statistical comparisons were performed, as these would have been inherently biased given the descriptive nature of the data.

For the primary outcome, the number of women with post-cesarean versus primary BE, with and without coexistent extra-bladder pelvic endometriosis, was summarized in a 2×2 contingency table. Coexistent pelvic endometriosis lesion localization at surgery was recorded according to the 2021 #Enzian classification [15]. Crude proportions were compared using Pearson's chi-squared test or Fisher's exact test, as appropriate. Odds ratios (OR) with 95% confidence intervals (CI) were calculated using logistic regression, with an exploratory—rather than conclusive—intent. Sensitivity analyses were conducted to assess the robustness of the findings: i) excluding cases of post-cesarean BE associated with vesicouterine fistula, to rule out alternative pathways of endometrial cell dissemination; ii) restricting the analysis to cases of primary BE with no history of prior pelvic surgery, to exclude the possibility of misclassified secondary BE resulting from surgical procedures other than CS; iii) restricting the analysis to studies with surgical confirmation of coexistent pelvic endometriosis in post-cesarean and primary BE, to reduce the risk of type I error (false positives due to the Magnetic Resonance Imaging (MRI) or Ultrasound (US) reporting of pelvic endometriosis when it was not actually present). All analyses were performed using STATA version 18 (StataCorp LLC, 2024, College Station, TX, USA).

Results

Of the 7,378 records initially identified, 4,499 were screened after duplicate removal. A total of 1,097 articles were sought for full-text retrieval, and 374 were assessed for eligibility. Ultimately, 81 studies (63 case reports and 18 case series) met the eligibility criteria and were included [16-96]. The PRISMA 2020 flow diagram is presented in **Figure 1**.

Studies overview

A total of 117 cases of BE were included, comprising 26 cases of post-cesarean BE and 91 cases of primary BE. A descriptive summary of study characteristics is presented in **Table 1**. Detailed case-level data are available in **Supplemental Tables 1, 2, and 3**. The quality assessment of included studies is reported in **Supplemental Tables 4 and 5**.

In the post-cesarean BE group, the mean age of included cases was 35.8 ± 6.2 years. The mean number of previous CS was 2.1 ± 1 (range: 1–4). In 15 out of 26 cases (57.7%), the time interval between the last CS and the diagnosis of BE was reported, with a mean duration of 8.2 ± 4.1 years (range: 2–15) (**Table 1, Supplemental Table 1**). Among cases with primary BE, the mean age was 32.8 ± 6.4 years (**Table 1, Supplemental Tables 2 and 3**).

In both groups, the most frequently reported localization of BE was the posterior bladder wall (38% in post-cesarean BE and 47% in primary BE), followed by the bladder dome (31% and 17%, respectively) (**Table 1**).

Dysuria was the most commonly reported urinary symptom at diagnosis (46% of post-cesarean BE cases and 44% of primary BE cases), followed by hematuria (27% and 26%, respectively). Additionally, in the post-cesarean group, patients more frequently reported non-specific symptoms, including abdominal or suprapubic pain or pressure (38%), acyclic pelvic pain (19%), and back pain (15%). In contrast, endometriosis-specific symptoms such as dysmenorrhea (19%) and dyspareunia (4%) were less common. Conversely, in the primary BE group, endometriosis-specific symptoms were more prevalent: dysmenorrhea (45%) and dyspareunia

(15%), while non-specific symptoms such as abdominal or suprapubic discomfort (16%), acyclic pelvic pain (14%), and back pain (2%) were less frequently reported (**Table 1**).

In both groups, the diagnostic work-up for BE included MRI, transvaginal US, and preoperative cystoscopy (with or without biopsy). Partial cystectomy was the most commonly reported surgical intervention, and minimally invasive techniques, such as laparoscopy, were employed in the majority of recent cases (**Table 1, Supplemental Tables 1, 2 and 3**).

Primary outcome: coexistent pelvic endometriosis in post-cesarean vs. primary bladder endometriosis

Among the 117 identified cases with BE, coexistent pelvic endometriosis was significantly less frequent in those with post-cesarean BE (5/26; 19.2%) compared to those with primary BE (72/91; 79.1%) ($p < 0.0001$, Fisher's exact test; **Table 2**). The odds of concomitant pelvic endometriosis were approximately 16 times lower in women with post-cesarean BE compared to those with primary BE (OR 0.06; 95% CI, 0.02-0.20; **Table 2**). In the post-cesarean BE group, coexistent pelvic endometriosis involved #Enzian compartments A (rectovaginal septum or posterior cul-de-sac; 2 cases), B (uterosacral ligaments; 3 cases), FA (uterus - external wall; 3 cases), and FU (fibrosis of the left ureter; 1 case) (**Supplemental Table 1**). Conversely, women with primary BE demonstrated a broader distribution of coexistent pelvic endometriosis lesions, including compartment O (ovaries; 27 cases), C (rectum; 7 cases), as well as other sites categorized as FI or FO—such as the sigmoid or transverse colon, ileum, psoas muscle, round ligament, periurethral region, or appendix (**Supplemental Tables 1 and 2**).

Among the 26 post-cesarean BE cases, two were associated with histologically confirmed vesicouterine fistulas (**Supplemental Table 1**). Of the 91 primary BE cases, 71 had no prior history of pelvic surgery, whereas 20 had undergone previous procedures (17 for endometriosis, 2 myomectomies, and 1 for surgical repair of a uterine perforation; **Supplemental Tables 2 and 3**). In one case each from the post-cesarean BE and primary BE groups, the diagnosis of coexistent

ovarian or deep endometriosis was based solely on imaging findings (**Supplemental Tables 1, 2, and 3**).

Sensitivity analyses, restricted by these potential confounding factors, consistently confirmed the significantly lower association of post-cesarean BE with coexistent pelvic endometriosis compared to primary BE (**Supplemental Table 6**).

Discussion

Main results and interpretation

According to this systematic review, the prevalence of coexistent pelvic endometriosis was significantly lower in women with post-cesarean BE than in those with primary BE. Moreover, in the few post-cesarean BE cases where coexistent pelvic endometriosis was identified, lesions typically had a confined distribution per the 2021 #Enzian classification, whereas primary BE more often showed extensive pelvic involvement.

These observations align with a previous case series [97] and support the hypothesis that peritoneal damage to the vesicouterine fold, combined with surgical dissemination of decidual fragments, may be *per se* sufficient for bladder wall lesion formation. Conversely, in cases of primary BE, repetitive and abundant retrograde menstruation remains the most plausible mechanism for widespread pelvic dissemination and implantation of endometrial tissue, often with multiple coexistent lesions.

In other words, primary BE would develop based on an individual predisposition that facilitates the implantation of transtubally refluxed endometrial fragments in the anatomical niche created by the anterior uterine aspect of an anteflexed uterus and the bladder dome. As primary BE is ‘merely’ a particular manifestation of a general disease, coexistent additional pelvic endometriotic lesions are expected in the pelvis. Contrariwise, post-cesarean BE may suggest that two specific mechanical factors, i.e., disruption of the peritoneum coupled with local dissemination of decidual fragments, could be sufficient for the development of an endometriotic nodule.

However, this does not imply that such lesions necessarily occur only in predisposed individuals. As a result, additional coexistent pelvic endometriotic lesions appear to be less frequently observed.

Despite the limited number of cases analyzed, due to stringent inclusion criteria, available evidence and clinical experience suggest that post-cesarean BE may be more common than traditionally thought. As early as 1960, Abeshouse BS and Abeshouse G pointed out that ~70% of BE cases had prior surgery, highlighting the importance of meticulous surgical technique to prevent iatrogenic dissemination [98].

Modern cesarean techniques, designed to shorten operating time, have improved postoperative recovery and represent a milestone in obstetric surgery [99]. However, current comparative studies of cesarean techniques primarily focus on short-term outcomes, with limited attention to potential long-term complications such as post-cesarean BE [99].

If the iatrogenic dissemination hypothesis holds, adequate operative techniques during CS should be adopted to reduce the incidence of postoperative endometriosis, including post-cesarean BE, but also abdominal wall endometriosis [100,101]. Uterine incision above the vesicouterine fold or, alternatively, careful bladder flap reconstruction after copious washing, may minimize exposure of mesenchymal tissues and prevent BE [102]. Furthermore, adequate intra-operative hemostasis must be ensured, as the presence of blood may promote the formation of deep lesions [103].

In our review, over half of reported cases occurred after 2000, paralleling the rising popularity of modern, faster cesarean techniques. Especially considering the increasing global rates of CS (from ~ 7% in 1990 to a projected 29% by 2030 [9,104]), one may wonder whether reducing the operating time by a few minutes is worth the risk of iatrogenic endometriosis.

Finally, the mean interval between CS and BE diagnosis was 8 years, with a range of 2 to 15 years. This is compatible with the well-known diagnostic delay, but also with a pathogenic trajectory allowing lesion development even after a long ‘dormant’ phase of ectopically dislocated endometrial fragments. If this is the case, it would be interesting to study the factor(s) that inhibit or promote bladder lesion development in these non-biologically predisposed women.

Strengths and limitations

The main strength of this systematic review lies in the use of rigorous inclusion and exclusion criteria, defined a priori within a PICOS-based protocol. The detailed case-by-case evaluation of each report allowed the application of strict diagnostic criteria for coexistent pelvic endometriosis. This methodological rigor reduced the risk of type I errors (false positives due to overdiagnosis) and type II errors (false negatives due to missed diagnoses).

However, several limitations must be acknowledged. First, due to the nature of the included studies, the analysis should be considered exploratory and cannot provide definitive conclusions. Second, the potential for publication bias cannot be excluded, as case reports are often unpublished, and some relevant cases may have been missed. This may also introduce referral bias and case selection bias, as more complex or atypical cases are more likely to be reported. Furthermore, considering the diagnostic delay in endometriosis, cases may have been underreported or misclassified. Additionally, the lack of granular data on surgical factors such as uterine incision type, bladder flap dissection, irrigation, or closure techniques limited our ability to identify specific procedural risks for BE, preventing firm preventive recommendations.

Finally, it cannot be ruled out that some post-cesarean BE developed secondary to another common complication of CS, such as cesarean scar defects (CSD), which may have acted as confounding or mediating factors. Nevertheless, CSDs are associated with heavy menstrual bleeding and have been independently linked to endometriosis, thereby supporting the retrograde menstruation hypothesis, which is not herein debated. However, when present, endometriotic implants associated with CSD and heavy retrograde bleeding are typically localized in the posterior compartment and along the uterosacral ligaments [105], not in the anterior compartment. Given the lack of accurate non-invasive diagnostic tools at the time of the reported cases—and given that most patients underwent uterine-sparing surgeries, which limited the macroscopic identification of CSDs—this possibility cannot be entirely excluded. Nonetheless, this alternative hypothesis does not fully explain the lower frequency of concomitant pelvic endometriosis in post-cesarean BE

compared with primary BE. Similarly, the absence of radical uterine surgery in most cases limited the ability to definitively rule out coexistent adenomyosis.

Conclusions

Post-cesarean BE represents a rare but well-documented clinical entity. Peritoneal discontinuation, combined with intraoperative dissemination of endometrial fragments during CS, may be sufficient to promote the formation of bladder wall endometriotic nodules, given the intrinsic capacity of endometrial cells to implant and proliferate—even without additional predisposing factors. In such cases, the disease typically remains confined to the bladder and, compared with primary BE, is less frequently associated with coexistent pelvic endometriosis.

Given the global rise in CS rates and the increasing adoption of faster, potentially less meticulous surgical techniques, the incidence of post-cesarean BE may increase. Therefore, we advocate for CS to be approached with heightened awareness, balancing short-term goals and enhanced recovery after surgery (ERAS) protocols with the prevention of potential long-term complications, including post-cesarean BE.

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Tables

Table 1. Descriptive summary of included cases characteristics by type of bladder endometriosis (post-cesarean and primary)

	Post-cesarean BE (n = 26)	Primary BE (n = 91)
General characteristics		
Age, years (mean $\pm$ SD)	35.8 $\pm$ 6.2	32.8 $\pm$ 6.4
Number of previous CS (mean $\pm$ SD)	2.1 $\pm$ 1	/
Time from last CS, months (mean $\pm$ SD) ^a	98.4 $\pm$ 49.6	/
BE localization		
Anterior wall	1 (4%)	3 (3%)
Posterior wall	10 (38%)	43 (47%)
Dome	8 (31%)	15 (17%)
Trigone	1 (4%)	2 (2%)
Base	2 (8%)	5 (6%)
Central	0 (0%)	2 (2%)
Left side	1 (4%)	0 (0%)
Right side	0 (0%)	2 (2%)
Not reported	3 (11%)	19 (21%)
Symptoms		
<i>Urinary symptoms</i>		
Dysuria	12 (46%)	40 (44%)
Hematuria	7 (27%)	24 (26%)
Incontinence	2 (8%)	4 (4%)
Pollakiuria	0 (0%)	12 (13%)
Frequency	8 (31%)	16 (18%)
Urgency	5 (19%)	8 (9%)

Nicturia	0 (0%)	3 (3%)
Urinary tract symptoms (unspecified)	0 (0%)	1 (1%)
Incomplete voiding or tenesmus	0 (0%)	3 (3%)
Mictalgia	0 (0%)	13 (14%)
Bladder pain	0 (0%)	3 (3%)
<i>Other symptoms</i>		
Acyclic pelvic pain or pressure	5 (19%)	13 (14%)
Abdominal or suprapubic pain or tension	10 (38%)	15 (16%)
Back pain	4 (15%)	2 (2%)
Dysmenorrhea	5 (19%)	41 (45%)
Dyspareunia	1 (4%)	14 (15%)
Dyschezia	0 (0%)	4 (4%)
Menstrual flow abnormalities	2 (8%)	7 (8%)
Infertility or subfertility	0 (0%)	18 (20%)
Bowel symptoms	1 (4%)	3 (3%)
Hematochezia	0 (0%)	1 (1%)
<i>No symptoms</i>	1 (4%)	2 (2%)

BE = bladder endometriosis; CS = cesarean section; SD = standard deviation.

^aReported in 15/26 cases (57.7%).

Table 2. Presence of coexistent pelvic endometriosis in post-cesarean bladder versus primary bladder endometriosis

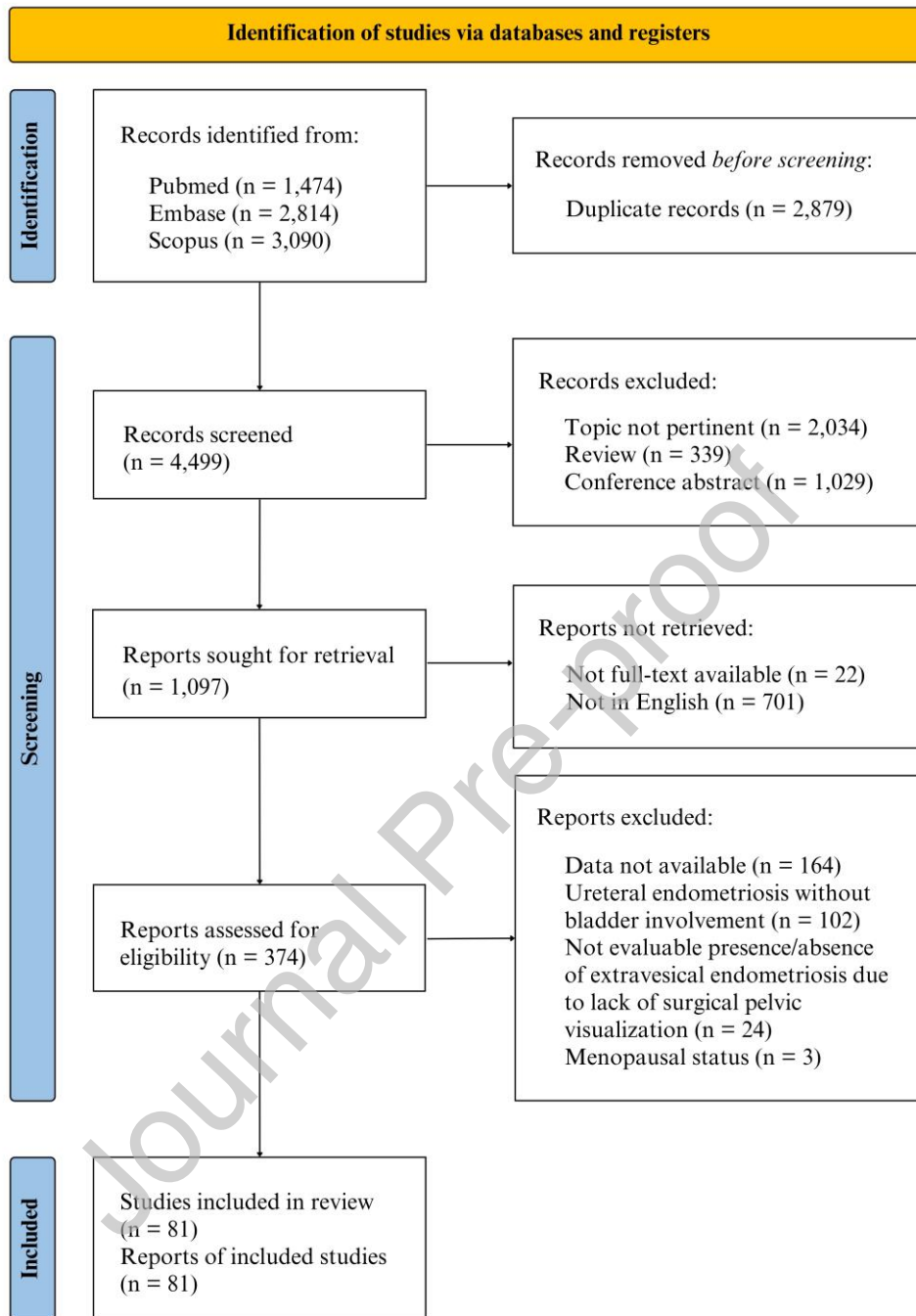
	Presence of coexistent pelvic endometriosis – n (%)	Absence of coexistent pelvic endometriosis – n (%)	Total – n (%)
Post-cesarean BE – n (%)	5 (19.2%)	21 (80.8%)	26 (100%)
Primary BE – n (%)	72 (79.1%)	19 (20.9%)	91 (100%)
Total – n (%)	77 (65.8%)	40 (34.2%)	117 (100%)

BE = bladder endometriosis.

$p < 0.0001$ (Fisher's exact test).

Odds ratio 0.06; 95% Confidence Interval, 0.02-0.20.

Percentages are reported by rows.



Figures

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram

Supplementary

Supplemental Appendix 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist

Supplemental Appendix 2. Literature searches

Supplemental Appendix 3. Data abstracted for each reported case, grouped by type of bladder endometriosis (post-cesarean and primary)

Supplemental Table 1. Characteristics of included cases of post-cesarean bladder endometriosis (n = 26)

Supplemental Table 2. Characteristics of included cases of primary bladder endometriosis, with no previous pelvic surgery (n = 71)

Supplemental Table 3. Characteristics of included cases of primary bladder endometriosis, with previous pelvic surgery (n = 20)

Supplemental Table 4. Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Reports

Supplemental Table 5. Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Series

Supplemental Table 6. Sensitivity analyses for the presence of coexistent pelvic endometriosis by type of bladder endometriosis (post-cesarean versus primary): i) excluding 2 cases of post-cesarean bladder endometriosis associated with vesicouterine fistula (n for post-cesarean bladder endometriosis = 24); ii) restricting the analysis to cases of primary bladder endometriosis with no history of prior pelvic surgery (n for primary bladder endometriosis = 71); iii) restricting the analysis to studies with surgical confirmation of coexistent pelvic endometriosis in post-cesarean and primary bladder endometriosis (n for post-cesarean bladder endometriosis = 25; n for primary bladder endometriosis = 90)

Graphical Abstract

