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Surgery Versus Medical Treatment for Deep Infiltrating Endometriosis: A Systematic Review of Pain, Quality of Life, Fertility, Recurrence, and Treatment-Related Complications

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Mosammat Shahana Jesmin [1], Saria Tasnim [2], Marjia Begum [3], Alauddin . [4], Farah Parisha Bhuiyan [5]

1. Department of Obstetrics and Gynecology, University Hospitals Coventry and Warwickshire NHS Trust, Coventry, GBR 2. Department of Cardiac Surgery, Dhaka Medical College and Hospital, Dhaka, BGD 3. Department of Obstetrics and Gynecology, Kuwait Bangladesh Friendship Government Hospital, Dhaka, BGD 4. Department of Pediatrics, National Institute of Cancer Research and Hospital, Dhaka, BGD 5. Department of Oncology, Ahsania Mission Cancer & General Hospital, Dhaka, BGD

Corresponding author: Mosammat Shahana Jesmin, jasminnhs@proton.me

Abstract

Deep infiltrating endometriosis (DIE) is associated with chronic pelvic pain, dysmenorrhea, deep dyspareunia, bowel and urinary symptoms, infertility, and impaired quality of life. Management includes hormonal treatment and surgery, but the comparative benefits and risks of these approaches remain uncertain. This review examines evidence concerning pain relief, quality of life, fertility, recurrence, and treatment-related complications in women with DIE. The available literature includes a limited number of direct comparisons between surgery and hormone-based treatment, together with observational surgical cohorts and studies comparing different surgical techniques. Both medical and surgical treatment have been associated with improvement in endometriosis-related pain. Surgical cohorts also report improvements in quality of life and bowel function, and pregnancies have been documented after excision of deep disease. However, most postoperative studies lack a nonsurgical control group, and comparisons between surgical techniques do not establish the relative effectiveness of surgery and medical treatment. Recurrence and clinically important bowel and urinary complications remain relevant considerations. The available evidence does not establish that surgery is universally superior to medical treatment. Management should therefore be individualized according to symptoms, lesion location and extent, reproductive plans, previous treatment, and the risks associated with the proposed intervention. The certainty of comparative conclusions is limited by the predominance of observational evidence and the inadequate recruitment of the available randomized trial.

Categories: Obstetrics/Gynecology
Keywords: deep infiltrating endometriosis, endometriosis surgery, fertility, hormonal treatment, surgical complications

Introduction And Background

Endometriosis is a chronic inflammatory disease characterized by the presence of endometrium-like tissue outside the uterine cavity. It may cause dysmenorrhea, chronic pelvic pain, deep dyspareunia, bowel or urinary symptoms, infertility, and reduced health-related quality of life. Deep infiltrating endometriosis (DIE), also termed deep endometriosis, refers to disease that extends into deeper pelvic tissues and may involve the uterosacral ligaments, rectovaginal septum, bowel, bladder, and ureters. The location and extent of these lesions influence the symptoms, anatomical distortion, and complexity of treatment [1-4].

Surgical treatment aims to remove endometriotic lesions and relieve associated fibrosis, adhesions, and anatomical distortion. Depending on the location and extent of disease, procedures may include laparoscopic excision, rectal shaving, discoid excision, segmental bowel resection, bladder excision, and ureterolysis or reconstruction [5]. Extensive disease may require a multidisciplinary team involving gynecologists, colorectal surgeons, urologists, radiologists, and fertility specialists. Although surgery may improve pain and organ-related symptoms, it also carries risks of bowel, urinary tract, vascular, neurological, and other complications. Persistent symptoms and recurrence may occur despite apparently complete excision [6].

Medical treatment principally aims to control symptoms by suppressing hormonal stimulation of endometriotic tissue. Treatment options include combined hormonal contraceptives, progestogens, levonorgestrel-releasing intrauterine systems, gonadotropin-releasing hormone (GnRH) agonists, and GnRH antagonists. These treatments avoid the immediate risks of major surgery and may provide symptom control, although adverse effects, incomplete symptom relief, and recurrence after discontinuation can limit their effectiveness. Hormonal suppression also generally prevents attempts at spontaneous conception while treatment continues [7,8].

The European Society of Human Reproduction and Embryology guideline recommends individualized management, consideration of surgery for pain, and referral of women with deep disease to centers with appropriate expertise [9]. However, these recommendations do not establish that surgery is more effective than medical treatment for every patient.

Direct comparison of these approaches is challenging. Women selected for surgery may have more extensive anatomical disease, severe symptoms, or inadequate responses to previous medical treatment. Conversely, women receiving medical treatment may differ in their fertility intentions, comorbidities, surgical suitability, and treatment preferences. The DIAMOND randomized controlled trial was designed to compare laparoscopic surgery with optimized medical management for deep endometriosis, but inadequate recruitment prevented a definitive comparison [10].

Consequently, an important evidence gap remains regarding the comparative effectiveness and safety of surgery and medical treatment. Postoperative improvements reported in surgical cohorts provide useful clinical information but cannot independently establish superiority over medical management. This review therefore examines direct comparative evidence alongside complementary primary studies reporting outcomes after surgery for DIE. The objective is to assess evidence concerning pain relief, quality of life, fertility, recurrence, and treatment-related complications while distinguishing postoperative improvement from evidence of comparative treatment effectiveness.

Review

Materials and methods

Study Design and Reporting Framework

This systematic review was conducted and reported in accordance with the PRISMA 2020 statement [11]. The literature-search methods were reported with reference to the PRISMA-S extension [12]. The review question, eligibility criteria, information sources, data-extraction procedures, and evidence-synthesis framework were established before final study selection. The review was not prospectively registered, and no registration number was assigned. Formal risk-of-bias assessment was not performed.

Review Question and Eligibility Criteria

The review population comprised reproductive-age women diagnosed with DIE through surgery, histopathology, or appropriate imaging. Eligible interventions included surgical excision and medical treatment with hormonal therapies. The primary outcome was endometriosis-associated pain, including chronic pelvic pain, dysmenorrhea, deep dyspareunia, and dyschezia. Secondary outcomes included validated quality-of-life measures, spontaneous pregnancy, clinical pregnancy, live birth, recurrence, repeat intervention, medication-related adverse effects, surgical complications, hospitalization, and cost-effectiveness.

Eligible study designs included randomized controlled trials, prospective comparative studies, retrospective comparative cohorts, and primary observational studies reporting relevant clinical outcomes after treatment for DIE. Direct comparisons between surgery and medical treatment constituted the principal evidence category. Surgical cohorts without a medical comparator were included as complementary evidence for postoperative outcomes but were not considered direct comparisons of treatment effectiveness. Studies comparing different surgical techniques, including rectal shaving and segmental resection, were analyzed separately.

Studies involving superficial endometriosis or isolated ovarian endometriomas were excluded unless DIE-specific outcomes could be extracted. Case reports, editorials, opinion articles, and studies without relevant clinical outcomes were excluded from the primary evidence synthesis. Systematic reviews and clinical guidelines were used for background information and citation searching but were not counted as primary studies.

Information Sources and Search Strategy

A comprehensive literature search was conducted using five electronic databases: MEDLINE through PubMed, Embase, Scopus, Web of Science Core Collection, and the Cochrane Central Register of Controlled Trials (CENTRAL). The searches covered the period from database inception to August 31, 2026. Reference lists of eligible primary studies and relevant systematic reviews were also examined to identify additional potentially eligible publications.

The search strategy combined controlled vocabulary, where available, with free-text terms relating to DIE, bowel endometriosis, rectovaginal endometriosis, surgery, excision, hormonal therapy, progestogens, and GnRH agonists or antagonists. Outcome-related terms included pain, quality of life, pregnancy, live birth, recurrence, and complications. No lower publication-date limit was applied.

The following search strategy was used in PubMed: (("Endometriosis"[Mesh] OR endometriosis[Title/Abstract] OR "deep endometriosis"[Title/Abstract] OR "deep infiltrating endometriosis"[Title/Abstract] OR "bowel endometriosis"[Title/Abstract] OR "rectovaginal endometriosis"[Title/Abstract]) AND (surgery[Title/Abstract] OR surgical[Title/Abstract] OR excision[Title/Abstract] OR laparoscopy[Title/Abstract] OR "rectal shaving"[Title/Abstract] OR "segmental resection"[Title/Abstract] OR "medical treatment"[Title/Abstract] OR hormonal[Title/Abstract] OR progestogen[Title/Abstract] OR progestin[Title/Abstract] OR "gonadotropin-releasing hormone"[Title/Abstract] OR GnRH[Title/Abstract]))

Equivalent search concepts were adapted for Embase, Scopus, Web of Science Core Collection, and CENTRAL. The database-specific search strategies and dates of execution were documented. Records retrieved from each database were recorded and incorporated into the study-selection process presented in the PRISMA 2020 flow diagram.

Study Selection and Data Extraction

All records retrieved from the five databases and additional citation searching were consolidated in reference-management software. Duplicate records were removed before screening. Two reviewers independently screened titles and abstracts against the predefined eligibility criteria. Full texts of potentially eligible publications were subsequently assessed independently by the same reviewers. Disagreements regarding study eligibility were resolved through discussion and consensus. Reasons for exclusion at the full-text stage were documented. Publications reporting results from the same patient cohort were identified and linked to avoid double-counting participants.

Data were extracted from the included studies using a structured approach. Extracted variables included author, publication year, country, study design, sample size, diagnostic criteria, lesion location, baseline symptoms, previous treatment, surgical technique, medical regimen, and follow-up duration. Clinical outcomes included pain scores, quality-of-life measures, spontaneous and clinical pregnancy, live birth, recurrence, repeat intervention, and treatment-related complications. Adjusted estimates and CIs were recorded when reported in the original publications.

Risk of Bias and Synthesis

Formal risk-of-bias assessments using the Cochrane Risk of Bias 2 (RoB 2) tool and the Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I) tool were not performed [13,14]. Accordingly, no formal study-level risk-of-bias judgments were assigned. Methodological limitations were considered descriptively, with attention to potential confounding by indication, patient selection, intervention classification, missing outcome data, outcome measurement, and selective reporting.

A narrative synthesis was undertaken because the included studies differed in design, disease location, treatment regimen, surgical technique, and outcome definitions. Direct comparisons between surgery and medical treatment were synthesized separately from uncontrolled surgical cohorts and studies comparing different surgical techniques. Where available, original study-reported effect estimates, CIs, and p-values were considered in interpreting individual findings. Meta-analysis was not performed because the available evidence was insufficiently homogeneous to support valid pooling. No pooled treatment-effect estimate was calculated.

Results

A total of 2,491 records were identified through electronic database searches and additional sources. After removal of 519 duplicates, 1,972 records underwent title and abstract screening. Following screening and full-text eligibility assessment, eight primary studies met the inclusion criteria and were included in the qualitative synthesis. The identification, screening, eligibility assessment, and inclusion processes are summarized in the PRISMA 2020 flow diagram (Figure *1*).

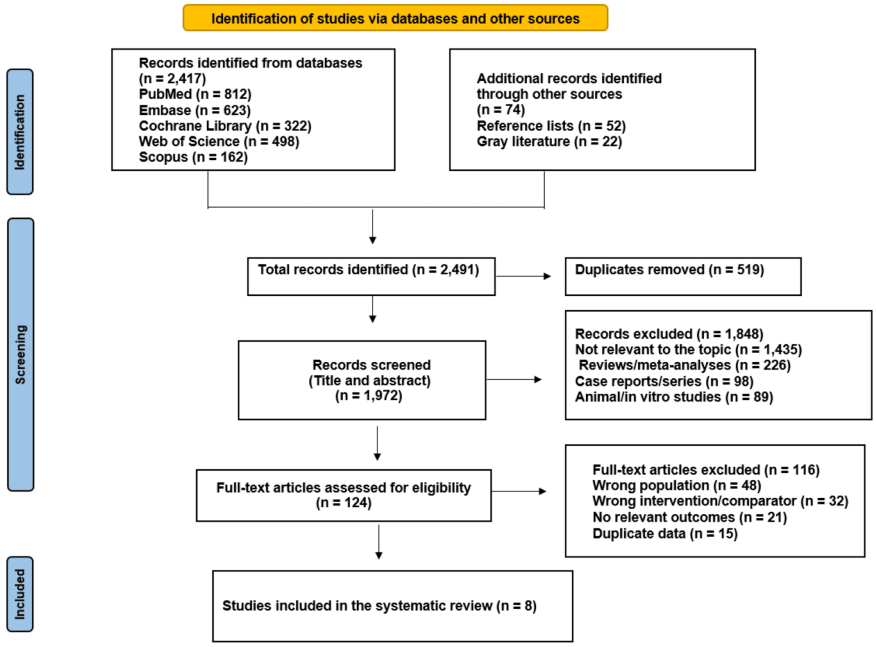


FIGURE 1: PRISMA 2020 flow diagram of study identification, screening, eligibility assessment, and inclusion in the systematic review.

The flow diagram illustrates the study selection process for the systematic review. A total of 2,491 records were identified through database searches (n = 2,417) and additional sources (n = 74). After removing 519 duplicates, 1,972 records underwent title and abstract screening, of which 1,848 were excluded. Full-text assessment was performed for 124 articles, and 116 were excluded for predefined eligibility criteria. Ultimately, eight primary studies were included in the qualitative synthesis.

DIE, deep infiltrating endometriosis

Study Characteristics

The broadened evidence framework includes direct comparative studies and primary cohorts reporting postoperative outcomes after surgery for DIE. The direct comparison by Rezende et al. included 122 women with bowel DIE treated surgically or with hormone-based therapy [15]. The DIAMOND trial was a randomized comparison intended to recruit 320 participants but randomized only 18 [10].

Complementary surgical studies include the multicenter prospective cohort reported by Byrne et al., the prospective cohort of 134 women undergoing bowel surgery reported by Hudelist et al., the retrospective cohort of 195 women reported by Bourdel et al., and the historical series of 193 women undergoing rectosigmoid resection reported by Raos et al. [16-19]. Additional cohorts evaluated gastrointestinal function and long-term pain, quality of life, fertility, and recurrence after surgery [20,21].

These studies contribute useful information across the review outcomes, but they do not all answer the same treatment question. In particular, a postoperative improvement in a surgical cohort cannot by itself demonstrate that surgery is superior to medical treatment. The characteristics and principal findings of the included studies are summarized in Table *1*.

Study	Design and population	Treatment or exposure	Main outcomes and findings	Evidence category
Cooper et al. [10]	Multicenter randomized trial; 18 participants randomized	Planned surgery versus optimized medical management	Recruitment and follow-up insufficient to estimate comparative effectiveness	Direct comparison, inconclusive
Rezende et al. [15]	Retrospective cohort; 122 women with bowel DIE	Surgery (n = 61) versus hormone-based treatment (n = 61)	Both groups improved; surgery was associated with greater and more sustained improvement in selected pain symptoms	Direct comparison
Byrne et al. [16]	Multicenter prospective cohort; 4,721 planned excisions among 5,162 women with rectovaginal endometriosis	Laparoscopic excision	Pain and quality of life improved; overall complication incidence 6.8%	Surgical outcomes
Hudelist et al. [17]	Prospective cohort; 134 women with colorectal DIE	Disk resection versus segmental resection	Both procedures improved pain and quality of life; pregnancy outcomes reported; serious complications in 5.9%	Surgical technique comparison
Bourdel et al. [18]	Retrospective cohort; 195 women with large rectovaginal nodules	Rectal shaving versus colorectal resection	Pain improved in both groups; pregnancy rates 73% and 69%; major complications more frequent after resection	Surgical technique comparison
Raos et al. [19]	Historical case series; 193 women with rectosigmoid DIE and pregnancy intention	Rectosigmoid resection	Pregnancy rate 60.6%; live-birth rate 53.9%	Fertility outcomes after surgery
Dior et al. [20]	Prospective cohort; 149 patients with deep endometriosis	Surgery	Bowel function and bowel-related quality of life improved	Surgical outcomes
Meuleman et al. [21]	Retrospective cohort; 56 patients with deep colorectal endometriosis	Multidisciplinary laparoscopic excision	Pain, quality of life, and sexual activity improved; recurrence and pregnancy outcomes reported	Surgical outcomes

TABLE 1: Primary studies contributing evidence on DIE outcomes.

This table summarizes the study designs, populations, interventions or exposures, principal clinical outcomes, and evidence categories of the eight included studies investigating surgical and medical management of DIE. The studies evaluated pain relief, quality of life, bowel function, fertility outcomes, pregnancy rates, recurrence, and treatment-related complications. Evidence included direct comparisons between surgery and medical treatment, comparisons of surgical techniques, and observational studies reporting outcomes following surgical intervention. The heterogeneity in study design, population characteristics, and outcome measures was considered when interpreting the findings.

DIE, deep infiltrating endometriosis

Direct Comparison of Surgery and Medical Treatment

Rezende et al. conducted a retrospective cohort study of 122 women with bowel DIE, with 61 women receiving surgery and 61 receiving hormone-based treatment [15]. Both groups experienced improvement in pain symptoms. Surgery was associated with greater and more sustained improvement in chronic pelvic pain, dyschezia, and deep dyspareunia. However, surgery was undertaken because of poor pain control, and some women received hormonal suppression after surgery. The results therefore reflect selected treatment pathways and cannot be interpreted as an unbiased causal comparison.

The DIAMOND trial was designed to compare early planned laparoscopic surgery, with or without adjuvant medical treatment, against optimized medical management alone [10]. The primary outcome was the pain domain of the Endometriosis Health Profile-30 at 18 months, with a planned economic evaluation. Although 377 patients were screened and 103 were eligible, only 18 participants were randomized against a planned sample of 320. No participant reached the primary 18-month outcome. The trial could not establish comparative clinical effectiveness or cost-effectiveness. Its failure to demonstrate a difference should not be interpreted as evidence that the two treatments are equivalent. The outcome-specific evidence and its principal limitations are summarized in Table *2*.

Outcome	Evidence identified	Interpretation	Principal limitation
Pain relief	Rezende et al. [15] and surgical cohorts	Both medical and surgical treatment were associated with improvement in pain; surgical cohorts reported postoperative improvement	Confounding by indication and limited direct comparative evidence
Quality of life	Byrne et al. [16], Dior et al. [20], Meuleman et al. [21]	Improvement following surgery was reported across disease-specific and general quality-of-life measures	Limited direct comparison with medical treatment
Fertility	Hudelist et al. [17], Bourdel et al. [18], Raos et al. [19]	Pregnancy and live birth were reported following surgery in selected patients	No reliable evidence of superiority over nonsurgical management
Recurrence	Bourdel et al. [18], Meuleman et al. [21]	Recurrence and repeat intervention were reported, with estimates varying by definition and follow-up	Heterogeneous definitions and limited comparative evidence
Surgical complications	Byrne et al. [16], Hudelist et al. [17], Bourdel et al. [18], Raos et al. [19]	Complication risk varied according to procedure and disease extent	Differences in case mix and complication definitions
Medical adverse effects	External hormonal-treatment literature	Hormonal treatment may cause treatment-related adverse effects that influence tolerability	Not adequately evaluated in the included comparative studies
Cost-effectiveness	DIAMOND trial [10]	Comparative cost-effectiveness remained unresolved	Insufficient recruitment and absence of completed primary outcome data

TABLE 2: Summary of evidence for clinical outcomes following surgical and medical treatment of DIE.

This table summarizes the evidence relating to pain relief, quality of life, fertility, recurrence, surgical complications, medical adverse effects, and cost-effectiveness in DIE. Evidence from the eight included primary studies is distinguished from external contextual literature. Direct comparisons between surgery and medical treatment are presented separately from observational surgical outcomes and surgical technique comparisons. The heterogeneity of study designs, populations, and outcome definitions limits definitive comparisons between treatment approaches.

DIE, deep infiltrating endometriosis

Pain Outcomes

Direct comparative evidence regarding pain relief was primarily provided by Rezende et al. [15]. Both the surgical and hormone-based treatment groups experienced improvement in pain symptoms. However, surgery was associated with greater and more sustained improvement in selected symptoms, including chronic pelvic pain, dyschezia, and deep dyspareunia. As treatment allocation was nonrandomized, these findings may have been influenced by differences in baseline symptoms, treatment selection, and postoperative hormonal suppression.

The DIAMOND trial was designed to compare early planned laparoscopic surgery, with or without adjuvant medical treatment, against optimized medical management alone [10]. Although 377 patients were screened and 103 were eligible, only 18 participants were randomized. No participant reached the primary 18-month outcome. Consequently, the trial could not establish comparative clinical effectiveness, and its findings cannot be interpreted as evidence of equivalence between surgery and medical treatment.

Postoperative improvements in pain were also reported in several surgical cohorts. In the multicenter prospective cohort reported by Byrne et al., women undergoing planned laparoscopic excision experienced significant reductions in premenstrual, menstrual, and noncyclical pelvic pain, deep dyspareunia, dyschezia, low back pain, and bladder pain at six months [16]. Improvements were generally maintained at two years, although improvement in voiding difficulty was an exception.

Bourdel et al. reported significant reductions in pelvic pain and dysmenorrhea following both rectal shaving and colorectal resection [18]. Mean pelvic pain scores decreased from 5.5 to 2.3 in the rectal-shaving group and from 7.3 to 2.0 in the colorectal-resection group. Meuleman et al. also reported improvements in gynecological pain following multidisciplinary laparoscopic excision [21]. These findings indicate postoperative symptom improvement but do not establish the superiority of surgery over medical treatment.

Bowel and Urinary Function

Bowel and urinary outcomes were reported mainly in observational surgical cohorts. In the Byrne et al. multicenter cohort, improvements were observed in bowel-related symptoms, including dyschezia, following laparoscopic excision [16]. Bladder pain also decreased during follow-up, although improvement in voiding difficulty was not maintained to the same extent as other reported symptoms.

Dior et al. prospectively followed 149 patients after surgery for deep endometriosis [20]. Mean bowel pattern scores improved from 4.8 before surgery to 4.2 at 12 months. The impact of bowel symptoms on quality of life improved from 5.5 before surgery to 4.4 at six months. Patients with direct lower gastrointestinal involvement and poorer baseline bowel function tended to experience greater improvement.

These findings suggest that surgery may improve bowel symptoms and bowel-related quality of life in selected patients. However, the absence of nonsurgical control groups in these cohorts limits conclusions about the comparative effectiveness of surgery and medical treatment.

Quality-of-Life Outcomes

Improvement in quality of life following surgery was reported in the Byrne, Dior, and Meuleman cohorts [16,20,21]. In the Byrne et al. study, median global quality-of-life scores increased from 55/100 before surgery to 80/100 at six months, with improvements maintained through two years [16]. Analgesic use also decreased, including opioid use from 28.1% before surgery to 16.1% at six months.

Dior et al. reported improvement in bowel-related quality of life following surgery, with the mean bowel-impact score decreasing from 5.5 before surgery to 4.4 at six months [20]. Meuleman et al. also reported significant improvements in quality of life and sexual activity after multidisciplinary laparoscopic excision [21].

Although these studies consistently reported postoperative improvement, differences in assessment instruments, follow-up periods, patient characteristics, and surgical procedures prevented direct comparison of the magnitude of benefit across studies. Most of these findings were derived from uncontrolled surgical cohorts and therefore do not demonstrate that surgery provides greater quality-of-life improvement than medical treatment.

Fertility and Pregnancy Outcomes

Fertility evidence primarily comes from surgical cohorts rather than direct comparisons with medical treatment. In the prospective cohort of 134 women with colorectal DIE reported by Hudelist et al., 61 women had a history of infertility. Among these, 26 conceived spontaneously and 13 conceived through in vitro fertilization, corresponding to an overall pregnancy rate of 63.4% in that subgroup [17]. The study compared disk resection with segmental resection, not surgery with medical treatment.

Bourdel et al. reported pregnancy rates of 73% after rectal shaving and 69% after colorectal resection among women seeking pregnancy [18]. These rates were not significantly different between the surgical techniques. In the historical cohort of 193 women undergoing rectosigmoid resection, Raos et al. reported postoperative pregnancy and live-birth rates of 60.6% and 53.9%, respectively [19]. Pregnancy occurred spontaneously in 20.2% of the full cohort, while the remainder of pregnancies involved intrauterine insemination or assisted reproductive technology.

These observations demonstrate that pregnancy and live birth are possible after surgery for bowel DIE. They do not establish that surgery improves fertility compared with expectant management or medical treatment, because the studies lacked an appropriate direct comparison. Fertility outcomes depend on age, ovarian reserve, tubal function, other infertility factors, reproductive intention, and use of assisted reproductive technology.

Recurrence and Repeat Intervention

Recurrence outcomes varied by study and definition. Meuleman et al. reported cumulative recurrence of 2% at one year and 7% at four years after multidisciplinary laparoscopic excision [21]. In the Bourdel et al. cohort, 13 women in the rectal-shaving group underwent repeat surgery for suspected recurrence, compared with none in the colorectal-resection group; the difference was not statistically significant [18]. The authors noted that the repeat operations did not all confirm recurrent endometriosis.

These results should not be interpreted as establishing a universal recurrence rate or as demonstrating that one surgical technique consistently prevents recurrence better than another. Differences in lesion extent, operative approach, postoperative hormonal treatment, follow-up duration, and the definition of recurrence limit comparisons. They also do not establish whether surgery prevents recurrence more effectively than medical treatment. The study characteristics and reported clinical outcomes are presented in Table *3*.

Study	Sample and design	Outcome assessed	Reported findings	Interpretation
Rezende et al. [15]	122 women with bowel DIE; retrospective comparative cohort	Chronic pelvic pain, dysmenorrhea, deep dyspareunia, dyschezia, and dysuria	Both surgery and hormone-based treatment improved pain; surgery was associated with greater and more sustained improvement in selected symptoms	Direct comparative evidence, limited by nonrandomized treatment allocation and possible confounding
Byrne et al. [16]	5,162 women with rectovaginal endometriosis across 51 specialist centers; multicenter prospective cohort	Pelvic pain, bowel and urinary symptoms, analgesic use, and quality of life	Pain and quality of life improved following planned laparoscopic excision, with benefits generally maintained during follow-up	Large multicenter evidence of postoperative improvement, but no medical-treatment control group
Hudelist et al. [17]	134 women with colorectal DIE; prospective cohort	Pain, fertility, and complications	Pain outcomes and pregnancies were assessed after disk or segmental bowel resection	Useful for surgical outcomes and technique comparisons, not direct comparison with hormonal treatment
Bourdel et al. [18]	195 women with large rectovaginal nodules; retrospective cohort	Pain, pregnancy, recurrence, and complications	Pain improved after rectal shaving and colorectal resection; pregnancy was reported in women seeking conception	Technique-specific observational evidence subject to selection bias
Raos et al. [19]	193 women undergoing rectosigmoid resection; historical cohort	Pregnancy and live birth	Postoperative pregnancies and live births were reported in a cohort with fertility intentions	Demonstrates reproductive outcomes after surgery but does not establish a fertility benefit over nonsurgical management
Dior et al. [20]	149 patients; prospective cohort	Bowel function and bowel-related quality of life	Bowel symptoms and their impact on quality of life improved following surgery	Supports postoperative functional improvement; comparative effectiveness remains uncertain
Meuleman et al. [21]	56 patients; retrospective cohort	Pain, quality of life, sexual activity, recurrence, and pregnancy	Improvements in pain and quality of life were reported after multidisciplinary laparoscopic excision	Small observational cohort with limited ability to establish long-term comparative effects

TABLE 3: Study characteristics and reported pain, quality-of-life, and fertility outcomes following treatment of DIE.

This table summarizes the clinical outcomes reported in seven studies evaluating surgical management of DIE. The outcomes include pelvic pain, dysmenorrhea, dyspareunia, bowel and urinary symptoms, quality of life, fertility, pregnancy, live birth, recurrence, and postoperative complications. Cooper et al. [10] was not included in this table because the DIAMOND trial did not produce completed primary outcome data. The predominantly observational nature of the included studies limits conclusions regarding the comparative effectiveness of surgery and medical treatment.

DIE, deep infiltrating endometriosis

Treatment-Related Complications

In the Byrne et al. cohort, the overall incidence of complications after planned laparoscopic excision was 6.8% [16]. Gastrointestinal complications, including enterotomy, anastomotic leak, or fistula, occurred in 1.1% of procedures, while urinary tract complications, including ureteric or bladder injury or leakage, occurred in 1.0%.

In the Bourdel et al. cohort, major complications occurred in 4% of women undergoing rectal shaving and 26% of those undergoing colorectal resection, a statistically significant difference [18]. The comparison was observational, and the resection group was small; the findings may therefore reflect differences in disease severity and surgical indication as well as procedure-related risk.

Hudelist et al. reported serious complications classified as Clavien-Dindo grades III-IV in 5.9% of the 134 women undergoing disk or segmental bowel resection, with no statistically significant difference between the two surgical groups [17]. Raos et al. reported grade III complications in 16.6% of the 193 women

undergoing rectosigmoid resection [19]. These estimates should not be compared directly because patient populations, definitions, procedures, and reporting methods differed.

Medical treatment also has potential harms, including irregular bleeding, mood-related symptoms, sexual adverse effects, and drug-specific hypoestrogenic or bone-related effects. The available direct comparative evidence does not provide a sufficiently standardized basis to determine the overall safety superiority of surgery or medical treatment.

Discussion

Principal Findings

The expanded evidence base provides a broader view of outcomes following surgery for DIE than direct comparative studies alone. Observational cohorts consistently report improvement in pain and quality of life after surgical excision, while fertility studies document pregnancies and live births after surgery. However, direct comparative evidence remains insufficient to establish whether surgery is superior to medical treatment across all clinical outcomes.

The distinction between direct and indirect evidence is fundamental. A before-and-after surgical cohort can show that symptoms improved following an operation, but it cannot determine how much improvement would have occurred with medical therapy, expectant management, or changes in concomitant treatment. Similarly, comparisons between rectal shaving and segmental resection address the choice of surgical technique rather than the decision between surgery and medical treatment.

Pain and Quality of Life

The direct comparative cohort by Rezende et al. suggests that surgery may provide more sustained relief of selected pain symptoms in women with bowel DIE [15]. The large prospective cohort by Byrne et al. provides complementary evidence that pain, bowel and urinary symptoms, analgesic use, and quality of life can improve after laparoscopic excision [16].

Nevertheless, pain is multidimensional, and symptom improvement does not necessarily indicate complete disease eradication. Persistent pain may be associated with residual lesions, pelvic floor dysfunction, neuropathic mechanisms, or central sensitization. Treatment decisions should therefore consider the specific symptom pattern, anatomical findings, previous treatment response, and patient priorities [22,23].

The observed improvement in quality of life after surgery is clinically important, but the absence of robust direct comparisons limits claims of superiority over medical therapy. Future studies should use validated instruments, such as the Endometriosis Health Profile-30 [24], and report between-group differences with CIs at prespecified follow-up times.

Fertility Considerations

Surgical cohorts show that pregnancy is achievable after treatment of rectosigmoid DIE. However, postoperative pregnancy rates cannot be interpreted as proof that surgery improves fertility compared with medical management or expectant treatment. Fertility studies are particularly vulnerable to selection bias because they include women who intend to conceive and may subsequently use assisted reproductive technology.

Fertility-related decisions should account for age, ovarian reserve, tubal status, previous operations, lesion location, and other infertility factors. Surgery involving bowel or urinary tract structures also carries risks that must be balanced against anticipated benefits. Hormonal suppression may be useful for symptom control in women not seeking immediate pregnancy, but it generally prevents conception attempts while treatment continues [7,9,25].

Recurrence and Repeat Treatment

Recurrence should be separated into recurrent symptoms, imaging-confirmed lesions, confirmed disease at repeat surgery, and the need for additional treatment. These outcomes are not interchangeable. Some women undergo repeat intervention for pain without histologically confirmed recurrence, while others may have recurrent disease without undergoing another operation.

The available surgical cohorts show that recurrence and repeat intervention remain possible, but do not provide a reliable direct comparison with medical treatment. Postoperative hormonal suppression may be appropriate for selected women who are not seeking immediate pregnancy, although its effect must be distinguished from the effect of surgery itself.

Complications and Treatment Selection

Surgical risk varies substantially according to the organs involved, the extent of fibrosis, the need for bowel or urinary tract reconstruction, patient comorbidities, and specialist expertise. The large multicenter cohort demonstrates that surgery can be associated with improved symptoms and quality of life, but gastrointestinal and urinary tract complications remain important considerations [16].

The higher complication rate observed after colorectal resection than after rectal shaving in the Bourdel et al. cohort should be interpreted cautiously because the choice of procedure is influenced by lesion extent and depth [18]. More extensive disease may require more extensive surgery, and observational comparisons cannot completely separate procedural effects from differences in the underlying disease.

Medical treatment avoids immediate operative risks but has its own adverse effects and may require prolonged use or repeated treatment changes. The available evidence does not establish that either strategy is uniformly safer. Shared decision-making should explain both the potential benefits and the risks of each approach.

Strengths and Limitations

This systematic review has several strengths. It synthesizes evidence from eight primary studies addressing clinically important outcomes of DIE, including pain, quality of life, bowel function, fertility, recurrence, and treatment-related complications. The literature search covered five major electronic databases: PubMed, Embase, Scopus, Web of Science Core Collection, and CENTRAL. Reference lists of relevant publications were also examined to identify additional eligible studies. Two reviewers independently screened titles, abstracts, and full-text articles, with disagreements resolved through discussion and consensus. Furthermore, the review distinguishes direct comparisons between surgery and medical treatment from observational surgical cohorts and studies comparing different surgical techniques. This distinction is important because postoperative improvement in an uncontrolled surgical cohort does not establish the superiority of surgery over medical treatment.

The included studies had several methodological limitations that affected the certainty of the findings. These included nonrandomized treatment allocation, confounding by indication, limited direct comparisons with medical management, and differences in disease severity, lesion location, and surgical techniques. Women selected for surgery may have had more severe symptoms, extensive disease, or inadequate responses to previous medical treatment, whereas those receiving medical treatment may have differed in reproductive intentions, disease characteristics, or suitability for surgery. These differences may have influenced the observed outcomes independently of the treatment received. Variations in outcome definitions and follow-up duration further limited comparisons of recurrence, fertility, and complications. In particular, pregnancy, clinical pregnancy, and live birth represent distinct reproductive outcomes, while symptomatic recurrence and recurrence requiring repeat surgery are not interchangeable endpoints. Insufficient recruitment in the available randomized controlled trial also restricted conclusions regarding comparative effectiveness. The principal methodological limitations and their implications for interpretation are summarized in Table *4*.

Methodological issue	How it affects the evidence	Implication for this review
Confounding by indication	Women selected for surgery may have more severe symptoms, extensive lesions, or inadequate response to medical treatment	Differences between treatment groups may reflect baseline differences as well as treatment effects
Nonrandomized treatment allocation	Treatment selection may be influenced by clinician judgment, patient preferences, fertility plans, and surgical suitability	Observational associations should not be interpreted as causal effects
Absence of a medical control group	Surgical cohorts commonly compare symptoms before and after surgery without a nonsurgical comparator	Postoperative improvement does not establish superiority over medical treatment
Variation in lesion location	Bowel, bladder, ureteric, and rectovaginal disease have different clinical consequences and surgical requirements	Outcomes should be stratified by lesion location where data permit
Differences in surgical technique	Rectal shaving, discoid excision, and segmental resection are not interchangeable procedures	Comparisons between techniques should remain separate from surgery-versus-medical-treatment comparisons
Concomitant hormonal suppression	Postoperative medication may contribute to symptom control or recurrence prevention	Studies should distinguish surgery alone from surgery combined with postoperative hormonal treatment
Inconsistent outcome definitions	Symptom recurrence, radiological recurrence, repeat surgery, and treatment resumption measure different outcomes	Recurrence results should not be combined without compatible definitions
Heterogeneous fertility outcomes	Spontaneous pregnancy, assisted reproduction, clinical pregnancy, and live birth are distinct endpoints	Fertility outcomes should be reported separately and interpreted in light of reproductive intention
Variable follow-up duration	Short follow-up may miss recurrence or late complications	Long-term outcomes require adequate and clearly reported follow-up
Inadequately powered randomized evidence	The DIAMOND trial did not recruit enough participants to establish comparative effectiveness	The lack of a definitive randomized result is uncertainty, not proof of equivalent treatment effects
Incomplete search verification	Unverified database searches may miss eligible studies	Final study counts, risk-of-bias assessments, and the PRISMA flow diagram must await completion of the search and screening process

TABLE 4: Methodological limitations and their implications for interpreting evidence on surgical versus medical treatment of DIE.

This table summarizes the principal methodological limitations considered when interpreting the evidence on surgical and medical management of DIE. The limitations relate to treatment selection, study design, disease characteristics, surgical techniques, concomitant treatment, outcome definitions, fertility reporting, follow-up duration, and completeness of outcome data. These issues were considered descriptively during the narrative synthesis. Formal study-level risk-of-bias assessments using the Cochrane RoB 2 tool and ROBINS-I were not performed.

DIE, deep infiltrating endometriosis; RoB 2, Risk of Bias 2; ROBINS-I, Risk Of Bias In Non-randomized Studies of Interventions

The systematic review itself also has limitations. Although the study-selection process followed the PRISMA 2020 framework [11], formal study-level risk-of-bias assessments using the Cochrane RoB 2 tool [13] and ROBINS-I [14] were not performed. No formal GRADE assessment of certainty of evidence was undertaken. Consequently, methodological limitations were considered descriptively rather than through formal risk-of-bias classifications. In addition, the included studies differed in design, populations, disease characteristics, interventions, surgical techniques, and outcome measurements. This heterogeneity prevented meaningful quantitative pooling, and a narrative synthesis was therefore undertaken without calculating pooled treatment-effect estimates.

Overall, these limitations restrict the certainty of conclusions regarding the comparative effectiveness of surgery and medical treatment for DIE. The findings should be interpreted as a synthesis of the available comparative and observational evidence rather than definitive evidence that either treatment strategy is

universally superior. Treatment decisions should be individualized according to symptom severity, anatomical disease extent, reproductive plans, previous treatment response, and the potential benefits and risks of each approach.

Future Research Directions

Future research should prioritize adequately powered multicenter randomized controlled trials comparing surgical excision with optimized medical treatment in women with DIE. Such studies should use clearly defined eligibility criteria, standardized treatment protocols, and validated outcome measures, including pain scores and the Endometriosis Health Profile-30. Prespecified follow-up intervals should permit assessment of both short-term symptom improvement and long-term recurrence.

Studies should also report fertility outcomes separately, distinguishing spontaneous conception, assisted reproductive technology, clinical pregnancy, and live birth. Surgical complications should be classified using standardized systems, with separate reporting of bowel, urinary, vascular, and neurological complications. Longer follow-up is required to assess recurrence and repeat intervention reliably.

Future comparative studies should address baseline disease severity, lesion location, previous treatment, fertility intention, and concomitant postoperative hormonal therapy. Reporting adjusted effect estimates with 95% CIs would improve interpretation of treatment differences and reduce the risk of over-interpreting uncontrolled postoperative improvements.

Conclusions

Surgery for DIE is associated with improvements in pain, bowel function, and quality of life, with pregnancies and live births reported in selected women. However, treatment-related complications remain important, and a fertility benefit over medical or expectant management has not been established. Direct comparative evidence is limited, and the available randomized trial was inconclusive because of inadequate recruitment. Therefore, surgery cannot be considered universally superior to medical treatment. Management should be individualized according to symptoms, anatomical disease extent, reproductive plans, previous treatment response, and the risks associated with each approach.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Mosammat Shahana Jesmin, Saria Tasnim, Marjia Begum, Alauddin ., Farah Parisha Bhuiyan

Acquisition, analysis, or interpretation of data: Mosammat Shahana Jesmin

Drafting of the manuscript: Mosammat Shahana Jesmin, Saria Tasnim, Alauddin .

Critical review of the manuscript for important intellectual content: Mosammat Shahana Jesmin, Marjia Begum, Farah Parisha Bhuiyan

Supervision: Mosammat Shahana Jesmin, Farah Parisha Bhuiyan

Disclosures

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