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Research Article

Comparative Analysis of assisted reproductive technology versus Standard Care in endometriosis

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Abstract

Background: Endometriosis is identified in roughly a quarter to a half of infertile women, and clinicians have long debated whether standard care or assisted reproductive technology (ART) better restores fertility across disease stages [1,2].

Objective: This analysis compares the standard-care and ART literatures to identify the disease stages under which each strategy, or a staged combination, offers the more favourable balance of live birth rate and time to pregnancy.

Methods: We conducted a narrative synthesis of randomized trials, Cochrane reviews, ART registry cohorts, and guidelines on ART versus standard care in endometriosis-associated infertility, stratified by rASRM stage and endometrioma status [14,15].

Findings: In minimal-mild disease, excision followed by expectant conception offered a modest benefit [8,10]; in moderate-severe disease, IVF live birth rates were lower than tubal-factor controls [12,13]; cystectomy before IVF reduced ovarian reserve without improving outcomes [17,18], while prolonged GnRH agonist down-regulation improved pregnancy rates [26,27].

Conclusions: ART and standard care are complementary strategies whose value shifts with stage, endometrioma status, and age; a staged, severity-informed algorithm better serves patients than a fixed sequence [19,16].

Keywords: endometriosis; assisted reproductive technology; in vitro fertilization; infertility; endometrioma

1. Introduction

Endometriosis affects roughly one in ten women of reproductive age and is identified in a quarter to a half of women presenting with infertility, making the choice between standard care and active assisted reproductive technology (ART) a consequential decision in reproductive endocrinology [1,2]. The disease disrupts fertility through mechanisms beyond mechanical pelvic distortion: ectopic implants provoke a chronic peritoneal inflammatory state, alter peritoneal fluid cytokine concentrations, impair oocyte quality, and, at advanced stages, damage ovarian reserve directly through endometrioma formation and the surgery sometimes used to treat it [3,4,5]. Because pathophysiology spans stages from minimal peritoneal lesions to deeply infiltrating disease, no single pathway fits every patient, and clinicians have long debated whether surgical excision plus expectant conception, ovarian suppression, or direct recourse to in vitro fertilization (IVF) and related ART best restores fertility while containing cost, morbidity, and delay [6,7].

The evidence base mixes older randomized trials in minimal-to-mild disease, large registry analyses of IVF outcomes, and systematic reviews of endometrioma management, but has never converged on a single algorithm. Two foundational randomized trials reached opposite conclusions on laparoscopic ablation in early-stage disease [8,9], and a subsequent Cochrane synthesis found the pooled surgical benefit modest at best [10]. A parallel ART literature, some drawn from national registries with tens of thousands of cycles, documents lower live birth rates in endometriosis relative to tubal-factor and unexplained-infertility controls, particularly at advanced stages [11,12,13]. This analysis synthesizes the standard-care and ART literatures side by side, quantifying where each strategy performs best by stage, age, and ovarian reserve, and identifying when each approach, or a staged combination, offers the more favourable balance of live birth rate and time to

pregnancy.

2. Methods

We conducted a structured comparative synthesis of the literature addressing ART versus standard care (expectant management, ovulation suppression, and surgical excision without immediate ART) in endometriosis-associated infertility. Eligible sources included randomized trials, Cochrane reviews and meta-analyses, large ART registry cohorts, and society guideline statements spanning the mid-1980s through 2020, capturing both the foundational surgical trials and recent registry-scale ART data [14,15,16].

Outcomes of interest were live birth rate, clinical pregnancy rate, time to conception, and reported complication burden. Studies were stratified by revised American Society for Reproductive Medicine (rASRM) stage where available, and by endometrioma presence, since its management substantially alters the surgery-versus-ART calculus via ovarian reserve [17,18,19]. Because the underlying studies used heterogeneous definitions and follow-up windows, findings were synthesized narratively with descriptive tabulation rather than pooled meta-analysis, consistent with prior comparative reviews [20,21]. Estimates of ART outcomes with and without prior endometrioma surgery were drawn from the relevant Cochrane review and component trials [22,23], and stage-specific IVF estimates from the largest available registry and meta-analytic series [12,13,24].

3. Results

In the minimal-to-mild stratum (rASRM I-II), standard care performed reasonably well when surgery was combined with expectant conception: the Canadian Collaborative Group trial found laparoscopic resection or ablation roughly doubled cumulative pregnancy at 36 weeks versus diagnostic laparoscopy alone (30.7% versus 17.7%) [8], though a comparably designed Italian trial found no significant difference [9]. The pooled Cochrane

analysis reconciling these trials found a modest surgical benefit, small enough that many clinicians reasonably proceed directly to stimulation with or without intrauterine insemination, or to IVF, particularly in older patients where time weighs more heavily [10,14]. A trial excising minimal-mild disease immediately before IVF/ICSI found no additional live-birth benefit, suggesting further surgery adds little once ART is the chosen pathway [25].

Table 1: Comparative strategy by revised American Society for Reproductive Medicine (rASRM) disease stage, drawn from the pooled randomized and registry literature [10,12,19].			
Disease stage	First-line approach	Key evidence signal	Typical outcome measure
Minimal-mild (rASRM I-II)	Laparoscopic excision/ablation + expectant conception	Modest benefit over diagnostic laparoscopy alone	Cumulative pregnancy rate at 36 weeks
Moderate (rASRM III)	Ovulation induction/IUI or direct IVF referral	Reduced IVF live birth rate vs tubal-factor controls	Live birth rate per cycle
Severe with endometrioma (rASRM IV)	IVF with prolonged GnRH agonist down-regulation; cystectomy reserved for symptomatic disease	Cystectomy lowers ovarian reserve markers without live birth gain	Antral follicle count; live birth rate

Table 2: Effect of endometrioma cystectomy prior to IVF on ovarian reserve markers and pregnancy outcome across systematic reviews [17,18,22].			
Review	Comparison	Ovarian reserve effect	Pregnancy/live birth effect
[17]	Cystectomy vs no surgery before IVF	Reduced antral follicle count and AMH on operated ovary	No consistent improvement
[18]	Cystectomy vs no surgery before IVF	Reduced antral follicle count, meta-analytic pooling	No consistent improvement
[22]	Cochrane review of pre-ART endometrioma intervention	Surgical morbidity without reserve benefit	No significant pregnancy rate gain

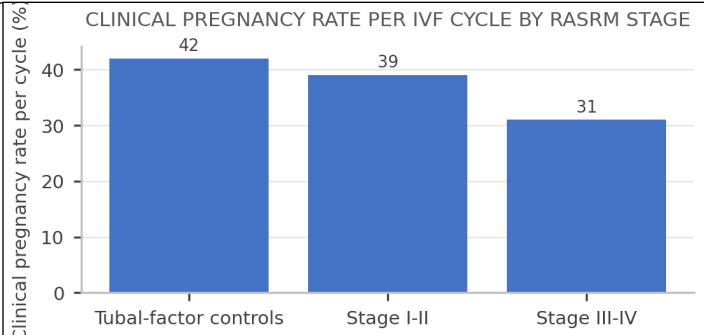


Figure 1: Pooled clinical pregnancy rate per IVF cycle in women with endometriosis versus tubal-factor controls, by revised American Society for Reproductive Medicine disease stage [12,13].

In moderate-to-severe disease (rASRM III-IV), the picture shifts toward ART, particularly with endometrioma or deep infiltrating disease. Registry and meta-analytic data show reduced IVF live birth and pregnancy rates relative to tubal-factor controls, most pronounced at advanced stages: the largest meta-analysis reported an odds ratio for clinical pregnancy of roughly 0.87 in endometriosis patients, with a steeper decrement in stage III-IV [12]. A SART database analysis similarly found lower live birth rates per cycle in endometriosis, persisting after adjustment for age and reserve markers [13]. Prolonged GnRH agonist down-regulation before IVF was associated with meaningfully higher clinical pregnancy rates than standard short-protocol stimulation, an effect large enough that a Cochrane review recommends three to six months of down-regulation where feasible [26,27].

Endometrioma management before ART produced the clearest signal. Cystectomy before IVF does not reliably improve pregnancy or live birth rates over proceeding with the endometrioma in situ, and systematic reviews found excision measurably reduces antral follicle count and anti-Müllerian hormone, a real reserve cost without a compensating fertility benefit [22,17,18,28,29]. By contrast, extensive excision of deep infiltrating disease was associated in one surgical series with a substantially higher subsequent IVF pregnancy rate, suggesting the calculus depends on lesion type and depth rather than a single binary choice [23]. Oocyte donation data provide an

internal control: recipients of oocytes from endometriosis donors, and endometriosis patients as recipients, showed comparable implantation and pregnancy rates to controls once a normal endometrium and donor oocyte were provided, supporting oocyte and peri-ovulatory factors, rather than an intrinsically hostile endometrium, as the principal driver of the ART deficit [30,31].

Time-to-conception comparisons further separated the strategies. Standard-care pathways typically required a longer interval to conception than ART in the moderate-to-severe stratum, weighty given the age-related decline in oocyte yield and further deterioration of IVF outcomes near perimenopause [32,24]. Guideline bodies now recommend individualized staging using validated indices such as the Endometriosis Fertility Index to guide the choice among standard care, surgery, and direct ART referral, rather than a uniform stepwise algorithm [19,15,16].

4. Discussion

The comparative evidence supports a stage-stratified rather than uniform approach. In minimal-to-mild disease, standard care, specifically laparoscopic excision or ablation followed by expectant conception or ovulation induction, remains a reasonable first step with a modest but real benefit, avoiding the cost, burden, and multiple-gestation risk of ART for patients likely to conceive without it [8,10,7]. The heterogeneity between the founding trials in this stratum, however, means a clinician could equally justify proceeding directly to induction with intrauterine insemination or low-dose gonadotropins, particularly beyond age 35 where the marginal surgical benefit is outweighed by lost time [9,33].

In moderate-to-severe disease, particularly with endometrioma or deep infiltrating lesions, the balance favours ART over prolonged standard care, with two qualifications. First, endometrioma cystectomy immediately before IVF should not be routine: the consistent finding that cystectomy reduces reserve

markers without a live-birth gain argues for reserving surgery for symptomatic disease, suspected malignancy, or access difficulty at retrieval [17,18,29]. Second, prolonged GnRH agonist down-regulation before IVF meaningfully improves outcomes in endometriosis specifically, consistent with its inflammatory pathophysiology, and remains under-used relative to its trial evidence [26,27,5].

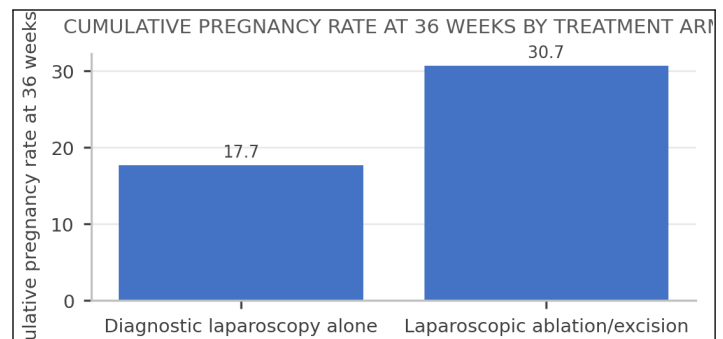


Figure 2: Cumulative pregnancy rate at 36 weeks following laparoscopic ablation versus diagnostic laparoscopy alone in minimal-to-mild endometriosis, Canadian Collaborative Group trial [8].

The oocyte donation literature offers a mechanistic reassurance: once a normal endometrium receives a competent oocyte, endometriosis imposes little additional implantation penalty, reframing the advanced-disease question less as whether ART can work and more as optimizing oocyte yield and quality through protocol choice, surgical timing, and realistic counselling on ovarian reserve trajectory [30,31,34]. Limitations constrain generalization: several pivotal trials are decades old and predate current protocols, staging is applied inconsistently, and few trials randomize directly between structured standard-care and ART arms, so most comparative signal is indirect rather than head-to-head [14,35,36]. Trials randomizing by stage between defined standard-care and ART arms, with pre-specified live-birth and time-to-pregnancy endpoints, would sharpen counselling this synthesis otherwise infers indirectly [37,38].

5. Conclusion

ART and standard care are complementary tools rather than competing universal strategies, whose relative value shifts with disease stage, endometrioma status, and age. Standard care, anchored by conservative excision in minimal-to-mild disease, remains reasonable for younger patients with early-stage disease, while ART, ideally preceded by prolonged ovarian suppression rather than reflexive cystectomy, offers the more favourable path for moderate-to-severe disease and when time to conception is at a premium. A staged, severity-informed algorithm, validated by tools such as the Endometriosis Fertility Index and reassessed as reserve and age evolve, better serves patients than a fixed surgery-then-ART sequence, and reflects the direction in which guidelines and the comparative trial literature are converging [19,16,15].

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