Volume 3, Issue 7, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

THE IMPACT OF PELVIC INFLAMMATORY DISEASE (PID) ON FEMALE FERTILITY: A REVIEW OF THE LITERATURE

Faiza Gul[*1], Maria Iqbal[2], Misbah Rehman[3]

[*1]*Obstetrics and Gynaecology Department, Maqsood Medical Complex (MMC) Ring Road Peshawar, Pakistan*
[2]*Lady Reading Hospital Peshawar, Pakistan*
[3]*Sir Ganga Ram Hospital, Lahore, Pakistan*

[*1]faizahussain766@gmail.com, [2]maryaa_iqbal@yahoo.com, [3]misbahrehman9909@gmail.com

DOI: https://doi.org/10.5281/zenodo.17085568

Keywords
Pelvic inflammatory disease, infertility, tubal factor, diagnosis, treatment.

Article History
Received: 18 June 2025
Accepted: 28 August 2025
Published: 09 September 2025

Corresponding Author: *
Faiza Gul

Abstract

Pelvic inflammatory disease (PID) is a significant gynecological pathology and is the predominant etiological factor underlying tubal factor infertility. Ascending polymicrobial infections, which are predominantly attributable to Chlamydia trachomatis and Neisseria gonorrhoeae, initiate an inflammatory cascade in the upper genital tract, culminating in salpingitis, tubo-ovarian adhesions, and irreversible tubal occlusion. The resulting structural and functional compromise of the fallopian tubes significantly impairs fecundity and predisposes individuals to adverse reproductive outcomes, including ectopic gestation. This review synthesizes the current literature on the pathophysiological correlates linking PID to infertility, with emphasis on immunological mechanisms, diagnostic modalities, and therapeutic interventions. Contemporary research underscores the pivotal role of molecular diagnostics, advanced imaging modalities, and laparoscopic evaluation in delineating disease progression and informing clinical management. Furthermore, preventive strategies, including widespread screening for sexually transmitted infections, improved antimicrobial stewardship, and public health initiatives targeting high-risk populations, are essential to mitigate the disease burden. The integration of early intervention with long-term reproductive counselling remains indispensable for reducing the sequelae of PID and optimizing reproductive outcomes.

INTRODUCTION

Pelvic inflammatory disease (PID) is a group of ascending inflammatory infections affecting the upper female genital tract (endometrium, salpinx, ovary, and pelvic peritoneum), including endometritis, salpingitis, tubo-ovarian abscess, and peritonitis (de Britto et al., 2023). Despite advances in sexual health, PID remains a primary cause of reproductive morbidity, such as tubal factor infertility (TFI), chronic pelvic pain (CPP), and ectopic pregnancy (Hillier et al., 2021; de Britto et al., 2023).

According to epidemiologic data, the annual prevalence of PID in women of reproductive age in high-income settings is 1-1.5%, with a significantly higher lifetime incidence. In the US, over one million incident cases occur annually, and approximately 2.5 million women have a history of PID (Boffetta et al., 2014). Infertility occurs in approximately 12% of cases following a single PID episode, 23% after two, and over 50% after three or more occurrences. In a 5-year retrospective cohort of hospitalised PID patients, 25%

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

experienced infertility, 14% had CPP, and 16% had recurrent PID (Gkrozou et al., 2021).

The global burden remains disproportionately concentrated in low- and middle-income regions, particularly Sub-Saharan Africa, where socioeconomic constraints, a lack of STI control infrastructure, and limited access to diagnostic methods (e.g., laparoscopy, POC molecular testing) contribute to high PID prevalence and sequelae (Hillier et al., 2021). In contrast, high-income countries have achieved reductions through coordinated preventative programs.

Pathogenetic mechanisms

Pelvic inflammatory disease (PID) is most commonly caused by *Chlamydia trachomatis* and *Neisseria gonorrhoeae*, but up to half of all cases are now attributed to a polymicrobial environment that includes anaerobes, bacterial vaginosis-associated organisms, Mycoplasma genitalium, and, in some cases, enteric or respiratory bacteria (Yusuf & Trent, 2023; Hillier et al., 2021). The ascending pathogens cause epithelial damage, ciliary dysfunction, and abnormal fibroadhesive healing processes, all of which increase hydrosalpinx development and tubal blockage. These pathological changes impair tubal patency, making affected women vulnerable to tubal factor infertility (TFI) and ectopic pregnancy (Yusuf & Trent, 2023; Haggerty & Ness, 2008).

Recurrent or badly managed infections increase these consequences through immunopathological pathways. Notably, increased C. trachomatis-specific antibody titres have been found to be adversely related to successful conception, underlining the negative influence of chronic inflammation on reproductive outcomes (Hillier et al., 2021; den Hartog et al., 2006). Clinical data show that even brief delays (≥3 days) in starting antimicrobial therapy might quadruple the risk of infertility, emphasising the significance of early intervention in disease management (Haggerty et al., 2010).

Diagnostic and therapeutic challenges

The clinical diagnosis of PID is intrinsically complex because it is mostly based on nonspecific symptoms such as lower abdomen pain, cervical motion sensitivity, and adnexal tenderness. These clinical criteria have only modest accuracy, with positive predictive values ranging from 65% to 90% when compared to laparoscopic confirmation, the diagnostic gold standard (Ross et al., 2006; Simms & Stephenson, 2010). Standard treatment regimens, such as cefoxitin and doxycycline or ceftriaxone and doxycycline, with or without metronidazole, remain the primary treatment options. However, these regimens are less successful against Mycoplasma genitalium, and the developing problem of antibiotic resistance makes effective management more difficult (Hillier et al., 2021; Yusuf & Trent, 2023).

Public health and prevention

Preventive interventions are critical for lowering the burden of PID and its reproductive consequences. Interventions such as systematic STI screening, partner notification and treatment, consistent condom promotion, comprehensive sexual health education, and ongoing vaccine development against *C. trachomatis* and *N. gonorrhoeae* have successfully reduced PID incidence in high-income countries (Hillier et al., 2021; Gottlieb et al., 2019). In contrast, resource-constrained settings continue to encounter hurdles, such as limited access to healthcare infrastructure, sociocultural barriers, and a lack of long-term public health programs, all of which impede efforts to reduce PID-related infertility (Rowley et al. 2019).

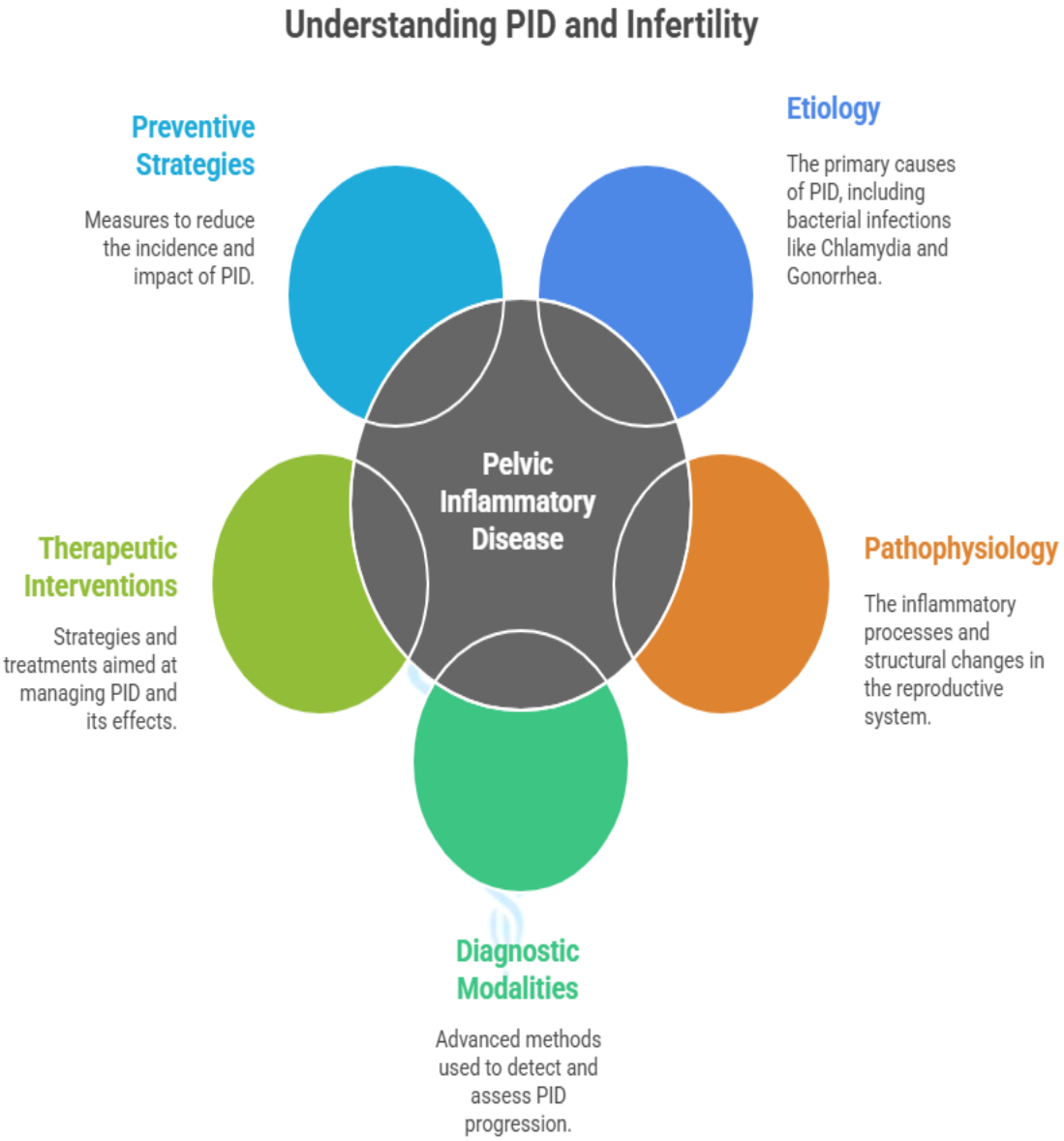
Scope of this review

This review provides an integrative synthesis of the current literature, covering epidemiology and global burden, evolving microbial aetiologies, pathophysiological mechanisms that impair fertility, diagnostic algorithms and limitations, management strategies such as antibiotic regimens, point-of-care diagnostics, and surgical interventions, and public health policy implications. Delineating these areas is critical for improving early detection, increasing therapy efficacy, and, eventually, minimizing the irreversible effects of PID on female reproductive health.

Volume 3, Issue 7, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593



Graphical abstract, understanding pelvic inflammatory disease and infertility

Pathophysiology of PID and infertility

Microbial etiology

Pelvic inflammatory disease (PID) is most usually caused by an increase in sexually transmitted infections, with *Chlamydia trachomatis* and *Neisseria gonorrhoeae* being the most common pathogens of concern (Yusuf & Trent, 2023). However, a larger polymicrobialaetiology is increasingly recognized, in which anaerobic bacteria, Mycoplasma genitalium, and bacterial vaginosis-associated species from the indigenous vaginal flora play important roles in disease pathogenesis (Hillier et al., 2021; Ross et al., 2006). This microbial diversity complicates diagnosis and therapy since mixed infections are frequently overlooked and can contribute to persistent subclinical inflammation, raising the risk of long-term reproductive consequences.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Mechanisms of infertility

The relationship between PID and infertility is established by a series of pathophysiological insults to the female reproductive tract. During the acute phase, fallopian tube infection causes mucosal oedema, epithelial sloughing, and purulent exudate production, all of which damage the delicate ciliary architecture required for gamete transport (Haggerty and Ness, 2008). Recurrent or incompletely treated infections increase the damage, resulting in fibrotic remodeling, scarring, and intratubal adhesions that jeopardize tubal integrity (Simms & Stephenson, 2010).

Tubal occlusion is a key consequence in which oocytes and sperm cannot pass through due to a persistent barrier. This not only causes infertility, but also significantly raises the likelihood of ectopic pregnancy due to abnormal implantation within a damaged tube (den Hartog et al., 2006). In addition to the tubes, infection-related inflammation frequently spreads to the peritoneal cavity, promoting the formation of PAs. These adhesions can bind the ovaries or disrupt the tubo-ovarian connection, making it difficult to collect the ovum during ovulation (Paavonen and Westrom, 1990).

Chronic PID can affect the endometrium, resulting in permanent endometritis. This disease lowers endometrial receptivity by changing immunological signaling pathways and affecting embryo implantation (Haggerty et al., 2010). Collectively, these processes demonstrate how PID impairs reproductive physiology at numerous levels, transforming microbial insults into clinically severe infertility.

Diagnosis of PID in the Fertility Context

Clinical diagnosis

The diagnosis of pelvic inflammatory disease (PID) remains a substantial clinical challenge in reproductive medicine, primarily because of its nonspecific symptomatology and variable presentation. Classically, women with PID may present with lower abdominal or pelvic pain, abnormal vaginal discharge, intermenstrual bleeding, fever, or dyspareunia. However, these clinical features overlap with several other gynecological and gastrointestinal disorders, complicating the diagnostic process (Mitchell &Prabhu, 2022). A further complexity arises from the high prevalence of subclinical or minimally symptomatic PID, which is estimated to account for up to 70% of cases in some cohorts and may silently progress to long-term reproductive sequelae such as tubal infertility and ectopic pregnancy (Westrom&Eschenbach, 2017; Ross et al., 2014). The inherent diagnostic uncertainty often leads to both overtreatment in women with suspected PID and undertreatment in those with silent disease, reflecting the delicate balance that clinicians must strike between timely intervention and avoidance of unnecessary antimicrobial exposure.

Laboratory and imaging approaches

Given the limitations of symptom-based diagnosis, laboratory and imaging modalities are frequently employed to complement clinical assessment. Cervical and vaginal swabs remain fundamental, with nucleic acid amplification tests (NAATs) now established as the most sensitive and specific diagnostic tool for detecting *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and *Mycoplasma genitalium* (Gaydos, 2017; Jensen et al., 2018). In addition to pathogen detection, nonspecific inflammatory markers such as C-reactive protein (CRP) and the erythrocyte sedimentation rate (ESR) may provide corroborative evidence, although their poor specificity limits their diagnostic value in isolation (Aghaizu et al., 2011).

Imaging modalities are particularly important in the examination of women with suspected tubo-ovarian abscesses or adnexal pathology. Transvaginal ultrasonography, which is commonly available and inexpensive, can detect hydrosalpinx, pyosalpinx, and complex adnexal masses, albeit early-stage disease may go undetected (Romosan et al. 2013). Magnetic resonance imaging (MRI) has a higher sensitivity for detecting pelvic inflammatory alterations, adhesions, and perihepatic involvement, making it a useful tool in complex or confusing cases (Takeuchi et al., 2013). These techniques are especially significant in the fertility context since they allow for noninvasive assessment of structural changes that may jeopardise reproductive results.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Gold standard: Laparoscopy

Despite technological developments, laparoscopy remains the diagnostic gold standard for PID. Its distinct feature is its capacity to enable direct visualization of the pelvic cavity, allowing for the confirmation of salpingitis, peritubal adhesions, and sequelae such as the perihepatitis associated with Fitz-Hugh-Curtis syndrome (Sweet, 2012). Furthermore, laparoscopy allows for simultaneous therapeutic procedures such as adhesiolysis, abscess drainage, and salpingectomy, making it both a diagnostic and a management tool. However, its invasive nature, need for specialized skills, and high cost make it unsuitable as a first-line technique (Table 1). As a result, it is typically reserved for cases of diagnostic ambiguity, severe illness, or infertility examinations requiring tubal patency and pelvic anatomy assessment (Curry et al., 2019).

Implications in the fertility context

In women seeking fertility evaluation, the diagnostic approach to suspected PID is especially important. Silent or recurring infections can cause mild but lasting tubal or endometrial damage that goes undiagnosed by normal clinical examination. In this context, identifying those at risk of tubal factor infertility requires a comprehensive diagnostic pathway that includes molecular microbiological testing, inflammatory biomarkers, advanced imaging, and, if necessary, laparoscopic assessment (Brunham et al., 2015; Walker &Tobler, 2021). Finally, early and precise diagnosis not only guides prompt antibiotic therapy, but it also plays an important role in protecting reproductive potential and avoiding long-term complications (Figure 1).

Table 1: Different types of PID, key features, advantages, limitations and relevance of evaluation

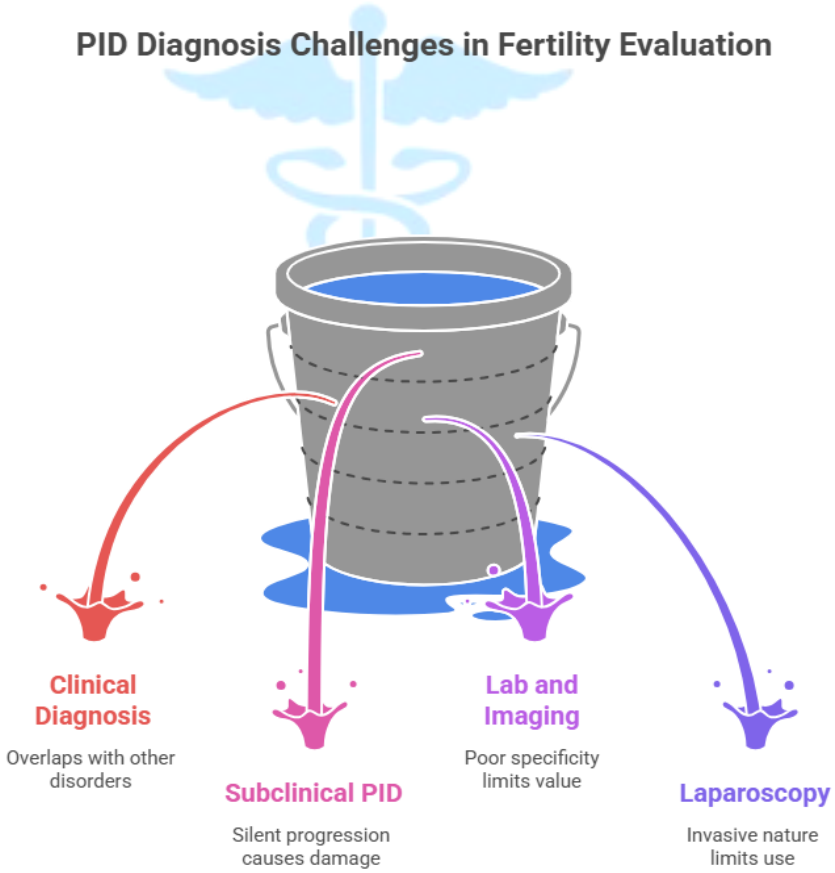
Diagnostic modality	Key features	Advantages	Limitations	Relevance to fertility	References
Clinical diagnosis	Pelvic pain, abnormal discharge, fever, cervical motion/adnexal tenderness	Rapid, inexpensive, bedside evaluation	Nonspecific, overlaps with other gynecological disorders; many cases subclinical	Early presumptive diagnosis allows prompt treatment to reduce tubal damage	Mitchell &Prabhu, 2022; Ross et al., 2014
Laboratory tests (swabs/NAATs)	Detection of *C.trachomatis*, *N.gonorrhoeae*, *M. genitalium*	High sensitivity/specificity with NAATs; guides targeted therapy	Limited to known pathogens; does not assess structural damage	Identifies causative organisms implicated in tubal pathology	Gaydos, 2017; Jensen et al., 2018
Inflammatory markers (ESR/CRP)	Elevated ESR and CRP suggest systemic inflammation	Supportive evidence; easy and inexpensive	Poor specificity; cannot distinguish PID from other causes	Adjunctive tool; limited fertility-specific insights	Aghaizu et al., 2011
Ultrasound (TVUS)	Detection of hydrosalpinx, tubo-ovarian abscess, adnexal pathology	Widely available, non-invasive, cost-effective	May miss early or subtle disease; operator-dependent	Visualizes tubal/ovarian sequelaeimpacting fertility	Romosan et al., 2013

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

MRI	High-resolution imaging of pelvic structures, adhesions, perihepatic involvement	Excellent sensitivity; detects subtle pelvic pathology	Expensive, less accessible; not first-line	Useful in complex cases and fertility assessments	Takeuchi et al., 2013
Laparoscopy (gold standard)	Fitz-Hugh-Curtis syndrome	Definitive diagnosis; allows simultaneous therapeutic intervention	Invasive, costly, requires expertise	Essential in infertility workup; assesses tubal patency and pelvic anatomy	Sweet, 2012; Walker &Tobler, 2021

Figure 1: Different types of PID diagnosis challenges in fertility evaluation



Impact of PID on Fertility Outcomes

Pelvic inflammatory disease (PID) has a profound and lasting effect on female reproductive potential, with infertility, ectopic pregnancy, and subfertility representing the most clinically significant sequelae. Epidemiological data suggest that even a single episode of PID carries an infertility risk of approximately 12%, whereas

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

recurrent episodes dramatically increase this risk, with three or more infections leading to tubal factor infertility (TFI) rates approaching 50% (Price et al., 2013; Westrom et al., 2020). The cumulative burden underscores the critical importance of timely diagnosis and effective treatment to mitigate irreversible reproductive damage.

Tubal damage constitutes the principal mechanism linking PID to infertility and ectopic pregnancy. The initial inflammatory insult induces ciliary destruction, epithelial denudation, and fibroadhesive repair, all of which compromise the delicate architecture of the fallopian tubes. These pathological changes predispose women to tubal occlusion, which not only prevents gamete transport but also markedly increases the risk of ectopic implantation, with studies reporting a six- to tenfold increase in ectopic pregnancy rates among women with prior PID (Macklon and Greer, 2016; Barnhart, 2021).

Subfertility, which is distinct from absolute infertility, reflects the insidious impact of PID on reproductive efficiency. Even in the absence of complete tubal occlusion, altered tubal motility, chronic salpingeal inflammation, and disruption of the peritoneal and endometrial microenvironments diminish the probability of successful fertilization and implantation (Rafiei et al., 2012; Haggerty and Ness, 2008). These subtle yet persistent effects indicate that women with a history of PID often require more time to conceive and are disproportionately represented among those seeking assisted reproductive technologies. Taken together, the reproductive sequelae of PID highlight its dual nature as both an acute infectious syndrome and a chronic reproductive health burden. Preventive strategies, early antimicrobial therapy, and careful fertility counselling remain essential to attenuate the long-term consequences of this condition.

Management Strategies

The treatment of pelvic inflammatory disease (PID) in the fertility setting necessitates a multifaceted therapeutic approach that balances the immediate requirement to control infection with the long-term goal of preserving reproductive potential. PID is more than just an acute gynecological emergency; it is also a chronic risk factor for infertility, ectopic pregnancy, and recurrent pelvic morbidity. Therefore, efforts should include early medical therapy, selective surgical techniques, reproductive technology, and preventative activities.

1. Medical treatment

Pharmacological therapy is the first-line treatment for almost all cases of PID. The key premise is to initiate broad-spectrum empiric antibiotics early to cover a wide range of microbiological spectra, including *Chlamydia trachomatis, Neisseria gonorrhoeae*, anaerobic bacteria, and *Mycoplasma genitalium* (Mitchell &Prabhu, 2022). Regimens commonly include a third-generation cephalosporin (e.g., ceftriaxone, single intramuscular dose), a tetracycline (e.g., doxycycline for 14 days), and metronidazole to improve anaerobic coverage (Ross et al., 2014).

Prompt antibiotic initiation has a substantial impact: statistics show that delays greater than 72 hours increase the probability of irreversible tubal pathology (Workowski and Bachmann, 2021). Even subclinical or slightly symptomatic PID, which may normally go untreated, can result in silent scarring that impairs fertility. Thus, current guidelines advise for a low barrier for empiric treatment, particularly in sexually active young women presenting with pelvic pain or adnexal sensitivity.

However, issues continue because to antimicrobial resistance, particularly the global increase in quinolone-resistant *N. gonorrhoeae* and macrolide-resistant *M. genitalium* (Unemo et al., 2019). This demands ongoing surveillance and updated treatment guidelines. Furthermore, adherence to lengthy oral regimens frequently diminishes in low-resource settings, emphasizing the significance of simpler or directly witnessed therapy for improving compliance.

2. Surgical interventions

Although medical therapy resolves acute infection in most women, a subset presents with tubo-ovarian abscesses, severe peritubal adhesions, or hydrosalpinx, necessitating surgical management.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Laparoscopic adhesiolysis or salpingostomy may restore fertility in women with limited tubal obstruction, although success rates vary depending on the severity and chronicity of the disease (Johnson et al., 2017).

Salpingectomy is often the recommended treatment choice for irreparably damaged tubes, particularly those with recurrent hydrosalpinx. Salpingectomy before IVF increases implantation rates by removing inflammatory exudate and generating embryotoxic fluid leaking from sick tubes (Strandell et al., 2019). While this reduces the likelihood of spontaneous conception, it improves ART outcomes, providing a reasonable trade-off for women with severe tubal illness.

Robot-assisted tuboplasty is an emerging surgical technique that provides improved visualisation and precision, but its cost and availability now hinder widespread implementation (Grynberg et al., 2020). Minimally invasive drainage treatments for tubo-ovarian abscesses, guided by interventional radiography, are also becoming increasingly common, potentially reducing the need for more extreme surgeries.

3. Assisted reproductive technology (ART)

For women whose tubal function cannot be restored, assisted reproductive technologies offer the most reliable pathway to parenthood. In vitro fertilization (IVF) effectively bypasses the fallopian tubes, rendering tubal occlusion irrelevant. Multiple studies have confirmed that IVF success rates in women with prior PID are comparable to those without tubal disease, provided that grossly damaged tubes are removed or occluded before embryo transfer (Dimitry et al., 2015; Walker and Tobler, 2021).

However, women with a PID history often present with a reduced ovarian reserve due to chronic pelvic inflammation, adhesions, or surgical interventions, which may modestly lower IVF success rates than idiopathic infertility cases (Li et al., 2018). Counselling should therefore emphasize realistic expectations, early recourse to ART, and individualized stimulation protocols to optimize outcomes.

Other ART modalities, such as intracytoplasmic sperm injection (ICSI), do not directly address tubal damage but may be indicated in couples with combined male factor infertility. Emerging technologies—such as in vitro activation of dormant follicles and uterine regenerative therapies—may also offer adjunctive benefit in select PID-related infertility cases, although these remain largely experimental (Donnez and Dolmans, 2021).

4. Prevention strategies

Despite advances in treatment, prevention remains the most cost-effective and sustainable strategy to reduce PID-associated infertility worldwide. Routine STI screening, particularly for *C. trachomatis*, has been proven to lower PID incidence when combined with partner notification and treatment (Huai et al., 2020). Screening programs have been successfully integrated into adolescent health services in high-income countries but remain inconsistently implemented in low- and middle-income settings due to financial and logistical barriers.

Public health interventions such as the promotion of condom use, sexual health education, and accessible family planning services play critical roles in reducing transmission. Digital health platforms and community-based outreach programs have shown promise in increasing the awareness and uptake of STI screening in underserved populations (O'Connor et al., 2020). Finally, the development of prophylactic vaccines against *C. trachomatis* and *N. gonorrhoeae* represents a major frontier in PID prevention (Figure 2). Although no licenced vaccine currently exists, several candidates are in clinical trials, raising hope for a paradigm shift in the long-term control of PID and its sequelae (Abdelrahman et al., 2021).

5. Adjunctive and supportive therapies

In addition to antimicrobial and surgical strategies, adjunctive therapies play an increasingly recognized role in the management of PID and its reproductive sequelae. Persistent chronic pelvic pain, recurrent inflammation, and compromised reproductive outcomes often necessitate supportive interventions beyond standard care.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Anti-inflammatory and immunomodulatory therapies have been investigated as potential adjuncts to reduce tissue damage. Nonsteroidal anti-inflammatory drugs (NSAIDs) are widely used to manage pelvic pain, although their role in preventing fibrosis or adhesions remains limited (Haggerty et al., 2010). Experimental models suggest that targeted immunomodulators, such as anti-TNF agents, may mitigate chronic salpingitis and adhesion, although these approaches are still under evaluation (Darville and Hiltke, 2010).

Fertility-supportive measures also include antioxidant supplementation (e.g., vitamins C and E, coenzyme Q10), which may reduce oxidative stress in the reproductive tract, and physiotherapy or pelvic floor rehabilitation to alleviate chronic pain syndromes (Radosa et al., 2018). While these interventions do not directly eradicate infection, they may improve quality of life and reproductive potential in women experiencing long-term consequences of PID (Table 2).

Emerging evidence further suggests that the female reproductive microbiome influences reproductive outcomes. The restoration of healthy vaginal and endometrial microbiota through probiotics or microbiome-modulating therapies is an evolving field that may, in the future, become an integral adjunct to PID management (Moreno and Simon, 2019) (Figure 2).

Table 2: Management Strategies for PID and Fertility Outcomes

Strategy	Intervention/Examples	Reproductive Implications	Key References
Medical treatment	Empiric broad-spectrum antibiotics- Ceftriaxone (single dose) + doxycycline (14 days) ± metronidazole	Reduces acute infection, prevents tubal damage, lowers risk of infertility and ectopic pregnancy	Workowski and Bolan (2015)
Surgical interventions	Laparoscopic adhesiolysis- Salpingostomy- Salpingectomy for irreversibly damaged tubes	Restores fertility in selected cases; salpingectomy improves IVF outcomes and reduces ectopic risk	Johnson et al. (2011); Keltz et al. (2006)
Assisted Reproductive Technologies (ART)	In vitro fertilization (IVF)- Tubal occlusion or removal prior to embryo transfer	Bypasses tubal pathology; IVF outcomes comparable to non-PID women when tubes are removed/occluded	Strandell et al. (2001); Zeyneloglu et al. (1998)
Prevention strategies	STI screening and partner treatment- Condom promotion- Public health education campaigns	Reduces incidence of PID and associated infertility, particularly effective in high-resource settings	Low et al. (2006); Gottlieb et al. (2010)
Adjunctive & supportive therapies	- Anti-inflammatory agents (NSAIDs)- Experimental immunomodulators (anti-TNF)- Antioxidants (Vit C, E, CoQ10)- Pelvic physiotherapy- Probiotics and microbiome restoration	Addresses chronic pain and inflammation, improves quality of life, and may enhance fertility outcomes	Haggerty et al. (2010); Radosa et al. (2018); Moreno and Simon (2019)

Volume 3, Issue 7, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

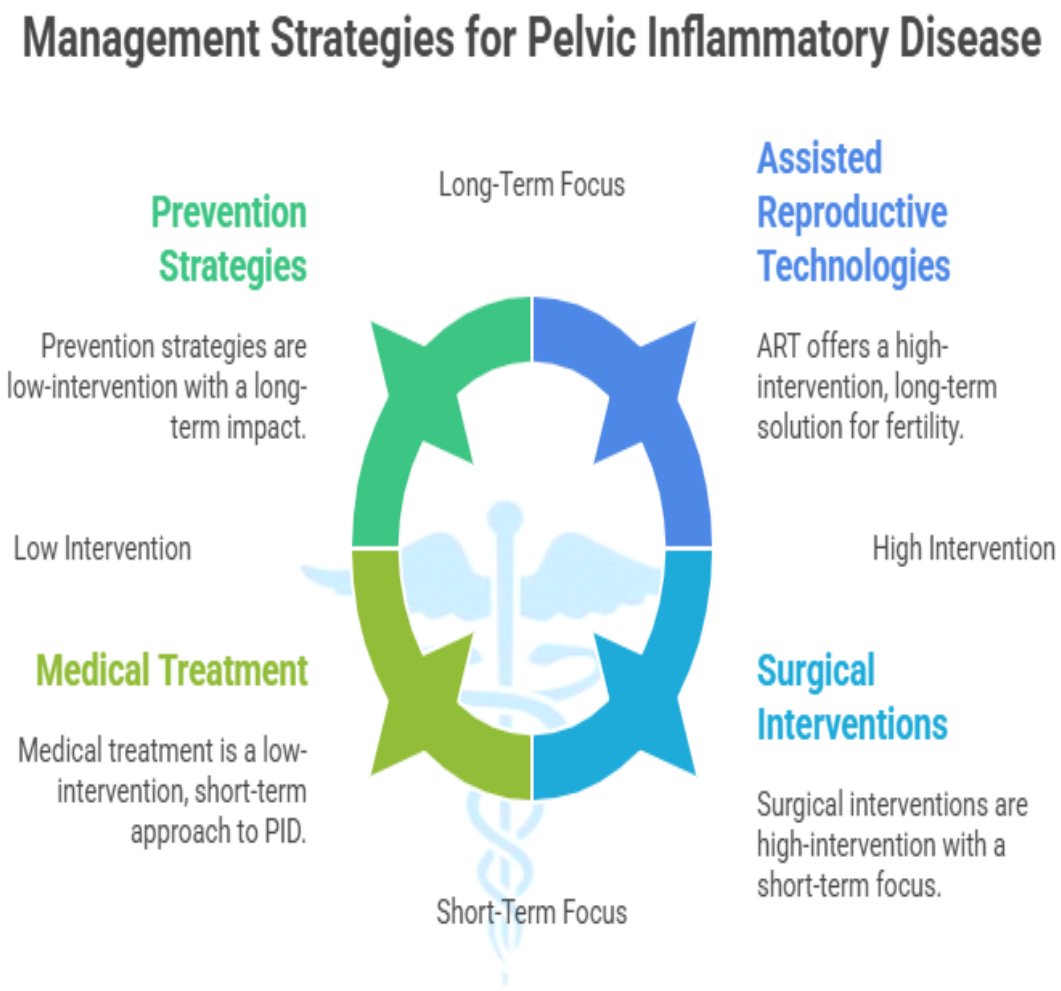


Figure 2: Different management strategies for pelvic inflammatory disease

Conclusion

Pelvic inflammatory disease (PID) remains a formidable challenge in reproductive medicine and represents one of the leading preventable causes of tubal factor infertility, ectopic pregnancy, and chronic pelvic morbidity in women worldwide. Its pathophysiology underscores the insidious nature of ascending infections, where acute microbial insults translate into irreversible tubal and endometrial damage through fibrosis, adhesion formation, and distortion of normal reproductive anatomy. Despite advances in antimicrobial therapy and early diagnosis, the persistence of subclinical presentations and the increasing prevalence of pathogens such as ***Mycoplasma genitalium***continue to hinder timely intervention.Fertility outcomes after PID are not uniformly dismal; however, the risk of infertility escalates significantly with recurrent or inadequately treated episodes. Assisted reproductive technologies, particularly in vitro fertilization, have revolutionized options for women with severe tubal disease, achieving pregnancy rates comparable to those of women without PID when preceded by salpingectomy or occlusion of the hydrosalpinx. However, access to such therapies remains limited in resource-poor settings, perpetuating global disparities in reproductive health.Future directions should prioritize the development of effective vaccines against ***C. trachomatis*** and ***N. gonorrhoeae***, the

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

incorporation of microbiome-modulating therapies, and context-sensitive screening programs to reduce the disease burden. Ultimately, safeguarding fertility in the context of PID requires not only clinical vigilance but also sustained investment in public health infrastructure, education, and reproductive justice worldwide.

References

Abdelrahman, Y.M., Belland, R.J. and Holland, M.J. 2021. Chlamydia vaccines: recent developments and the path ahead. Frontiers in Cellular and Infection Microbiology, 11, p.695488.

Aghaizu, A., Adams, E.J., Turner, K., Kerry, S., Hay, P., Simms, I. &Estcourt, C.S., 2011. What is the cost of pelvic inflammatory disease and how much could be prevented by screening for chlamydia in England? Sexually Transmitted Infections, 87(4), pp.312-317.

Barnhart, K.T. 2021.Ectopic pregnancy.New England Journal of Medicine, 384(18), pp.1731-1738.

Boffetta, P., Boccia, S. and La Vecchia, C. 2014. A quick guide to cancer epidemiology (pp. 46-50). New York: Springer.

Brunham, R.C., Gottlieb, S.L. &Paavonen, J., 2015.Pelvic inflammatory disease.New England Journal of Medicine, 372(21), pp.2039-2048.

Curry, A., Williams, T. & Penny, M.L., 2019. Pelvic inflammatory disease: diagnosis, management, and prevention. American Family Physician, 100(6), pp.357-364.

Darville, T. and Hiltke, T.J. 2010.Pathogenesis of genital tract disease due to Chlamydia trachomatis.Journal of Infectious Diseases, 201(Suppl 2), pp.S114-S125.

deBritto, L.C.V., Siqueira, R.D.M., de Barros, M.L.N.M. and Arrivabene, K.C.S., 2023. Pelvic Inflammatory Disease: updates from diagnosis to treatment. Brazilian Journal of Health Review, 6(5), pp.23011-23018.

denHartog, J.E., Morre, S.A., Land, J.A. &Bruggeman, C.A., 2006. Chlamydia trachomatis-associated tubal pathology: immunogenetic aspects and serological screening. Human Reproduction Update, 12(6), pp.719-730.

Dimitry, E.S., Decherney, A.H. and Laufer, N. 2015.Assisted reproductive technology in tubal disease.Fertility and Sterility, 103(6), pp.1429-1435.

Donnez, J. and Dolmans, M.M. 2021. Fertility preservation and restoration: focus on the human ovary. Reproductive Biomedicine Online, 42(5), pp.915-930.

Gaydos, C.A., 2017. Mycoplasma genitalium: accurate diagnosis is necessary for adequate treatment. Journal of Infectious Diseases, 216(suppl_2), pp.S406–S411.

Gkrozou, F., Tsonis, O., Daniilidis, A., Navrozoglou, I. and Paschopoulos, M., 2021.Tubo-ovarian abscess: Exploring optimal treatment options based on current evidence. Journal of Endometriosis and Pelvic Pain Disorders, 13(1), pp.10-19.

Gottlieb, S.L., Low, N., Newman, L.M., Bolan, G., Kamb, M., Broutet, N. and Broutet, N. 2010. Toward global prevention of sexually transmitted infections (STIs): the need for STI vaccines. Vaccine, 28(Suppl 1), pp.A1-A10.

Gottlieb, S.L., Ndowa, F., Hook, E.W. & Deal, C., 2019. The global roadmap for advancing development of vaccines against sexually transmitted infections: Update and next steps. Vaccine, 37(50), pp.7371-7379.

Grynberg, M., Poulain, M. and Seroka, A. 2020. Robotics in reproductive surgery: an update. Current Opinion in Obstetrics and Gynecology, 32(4), pp.257–264.

Haggerty, C.L. & Ness, R.B., 2008.Epidemiology, pathogenesis and treatment of pelvic inflammatory disease.Expert Review of Anti-infective Therapy, 6(6), pp.875–887.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Haggerty, C.L., Gottlieb, S.L., Taylor, B.D., Low, N., Xu, F. and Ness, R.B. (2010).Risk of sequelae after Chlamydia trachomatis genital infection in women.Journal of Infectious Diseases, 201(Suppl 2), pp.S134-S155.

Hillier, S.L., Bernstein, K.T. and Aral, S., 2021.A review of the challenges and complexities in the diagnosis, etiology, epidemiology, and pathogenesis of pelvic inflammatory disease. The Journal of infectious diseases, 224(Supplement_2), pp.S23-S28.

Hillier, S.L., Bernstein, K.T., Aral, S.O. & Holmes, K.K., 2021. Bacterial vaginosis: epidemiology, pathogenesis, and clinical management. Clinical Microbiology Reviews, 34(4), pp.e00069-19.

Huai, P., Li, F., Chu, T., Liu, D., Luo, L. and Dong, H. 2020. Chlamydia screening for preventing pelvic inflammatory disease and its sequelae: a meta-analysis. International Journal of Environmental Research and Public Health, 17(11), p.4183.

Jensen, J.S., Cusini, M., Gomberg, M., Moi, H., Wilson, J.D. &Unemo, M., 2018.European guideline on Mycoplasma genitalium infections.Journal of the European Academy of Dermatology and Venereology, 32(11), pp.1684–1694.

Johnson, N., van Voorst, S., Sowter, M.C., Strandell, A. and Mol, B.W. (2010). Surgical treatment for tubal disease in women due to undergo in vitro fertilisation.Cochrane Database of Systematic Reviews, 2010(10), CD002125.

Keltz, M.D., Olive, D.L. and Olive, D.L. 2006.Surgical management of infertility.Clinical Obstetrics and Gynecology, 49(1), pp.145–163.

Li, Z., Wang, A.Y., Bowman, M., Hammarberg, K., Farquhar, C., Johnson, L. and Sullivan, E.A. 2018. Iatrogenic infertility from pelvic inflammatory disease: impact on IVF outcomes. Human Reproduction, 33(11), pp.2045–2054.

Low, N., Bender, N., Nartey, L., Shang, A. and Stephenson, J.M. 2006. Effectiveness of chlamydia screening: systematic review. International Journal of Epidemiology, 35(2), pp.336–344.

Macklon, N.S. and Greer, I.A. 2016.Reproductive sequelae of pelvic inflammatory disease. Best Practice & Research Clinical Obstetrics &Gynaecology, 36, pp.95–104.

Mitchell, C. and Prabhu, M. 2022. Pelvic inflammatory disease: current concepts in pathogenesis, diagnosis and treatment. Infectious Disease Clinics of North America, 36(2), pp.223-240.

Moreno, I. and Simon, C. 2019. Deciphering the effect of reproductive tract microbiota on human reproduction.Reproductive Medicine and Biology, 18(1), pp.40–50.

O'Connor, E.A., Lin, J.S., Burda, B.U., Henderson, J.T. and Whitlock, E.P. 2020. Screening for chlamydial and gonococcal infections: A systematic review for the U.S. Preventive Services Task Force. Annals of Internal Medicine, 172(2), pp.116–125.

Paavonen, J. &Westrom, L., 1990.Pelvic inflammatory disease. In: Holmes, K.K., Mårdh, P.A., Sparling, P.F. &Wiesner, P.J. (eds.) Sexually Transmitted Diseases. New York: McGraw-Hill, pp.593–615.

Pavletic, A.J., Wölner-Hanssen, P., Paavonen, J., Hawes, S.E. and Eschenbach, D.A., 1999.Infertility following pelvic inflammatory disease. Infectious Diseases in Obstetrics and Gynecology, 7(3), pp.145-152.

Price, M.J., Ades, A.E., Soldan, K., Welton, N.J., Macleod, J., Simms, I., Turner, K.M. and Horner, P.J. 2013. Pelvic inflammatory disease and fertility: cohort study, systematic review and meta-analysis. Sexually Transmitted Infections, 89(8), pp.611-617.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Radosa, M.P., Meyberg-Solomayer, G., Kastl, C., Radosa, J., Mavrova, R., Gräber, S. and Baum, S. 2018. Influence of physiotherapy on chronic pelvic pain and quality of life in women with gynecological diseases: a randomized controlled trial. Archives of Gynecology and Obstetrics, 297(4), pp.919-926.

Rafiei, R., Akbari-Asbagh, F., and Karimi-Zarchi, M. 2012.Tubal factor infertility, diagnosis and management.Journal of Reproduction & Infertility, 13(2), pp.69–76.

Romosan, G., Valentin, L., and Sladkevicius, P. 2013. Imaging in pelvic inflammatory disease.Ultrasound in Obstetrics & Gynecology, 41(4), pp.337–344.

Romosan, G., Valentin, L., Wehlin, L., Hagberg, H. &Valentin, L., 2013.Diagnostic performance of transvaginalsonography in pelvic inflammatory disease.Ultrasound in Obstetrics & Gynecology, 41(6), pp.696–704.

Ross, J., Cronjé, H. &Paszkowski, T., 2006. Pelvic inflammatory disease: diagnosis and management. Journal of the Royal Society of Medicine, 99(10), pp.557–560.

Ross, J.D.C., Cronjé, H.S., and Paszkowski, T. 2014. Pelvic inflammatory disease diagnosis and management. Best Practice & Research Clinical Obstetrics &Gynaecology, 28(6), pp.977-994.

Ross, J.D.C., Jensen, J.S. and Mabey, D. 2014. Pelvic inflammatory disease. BMJ Clinical Evidence, 2014, p.1606.

Rowley, J., Vander Hoorn, S., Korenromp, E., Low, N., Unemo, M., Abu-Raddad, L.J., Chico, R.M., Smolak, A., Newman, L. & Gottlieb, S., 2019. Chlamydia, gonorrhoea, trichomoniasis and syphilis: global

Simms, I. & Stephenson, J.M., 2010. Pelvic inflammatory disease epidemiology: what do we know and what do we need to know? Sexually Transmitted Infections, 86(1), pp.4–7.

Strandell, A., Lindhard, A., and Gudmundsson, J. 2019. Hydrosalpinx and IVF outcome: a prospective, randomized multicentre trial in Scandinavia on salpingectomy prior to IVF. Human Reproduction, 34(5), pp.1062–1071.

Strandell, A., Lindhard, A., Waldenström, U., Thorburn, J. and Janson, P.O. 2001. Hydrosalpinx and IVF outcome: a prospective, randomized multicentre trial in Scandinavia on salpingectomy prior to IVF. Human Reproduction, 16(11), pp.2403–2410.

Sweet, R.L., 2012. Pelvic inflammatory disease: current concepts of diagnosis and management. Current Infectious Disease Reports, 14(2), pp.194–203.

Takeuchi, M., Matsuzaki, K., Harada, M., Nishitani, H., and Ishigaki, T. 2013. Magnetic resonance imaging of female pelvic inflammatory disease: a pictorial review. Japanese Journal of Radiology, 31(5), pp.295-303.

Takeuchi, M., Matsuzaki, K., Nishitani, H. & Ueda, F., 2013.Magnetic resonance manifestations of pelvic inflammatory disease.Journal of Magnetic Resonance Imaging, 37(2), pp.509-514.

Unemo, M., Lahra, M.M., Cole, M., Galarza, P., Ndowa, F., Martin, I., Dillon, J.R., Galas, M., Ramon-Pardo, P., Bolan, G. and Wi, T. 2019. World Health Organization Global Gonococcal Antimicrobial Surveillance Program (WHO GASP): review of new data and evidence to inform international public health policies. Sexually Transmitted Infections, 95(7), pp.368–377.

Walker, C.K. &Tobler, K.J., 2021. Female infertility: Tubal factors. Fertility and Sterility, 115(2), pp.235–241.

Westrom, L. &Eschenbach, D., 2017.Pelvic inflammatory disease. In: Holmes, K.K., Sparling, P.F., Stamm, W.E., Piot, P., Wasserheit, J.N., Corey, L., Cohen, M.S. & Watts, D.H. (eds.) Sexually Transmitted Diseases. 4th ed. New York: McGraw-Hill, pp.1017–1050.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Westrom, L., Joesoef, R., Reynolds, G., Hagdu, A., and Thompson, S.E. (2020). Pelvic inflammatory disease and fertility: a cohort study of 1,844 women with laparoscopically verified disease. Sexually Transmitted Diseases, 47(7), pp.433–439.

Wiesenfeld, H.C. and Sweet, R.L. (2013).Progress in the management of pelvic nflammatory disease.Current Opinion in Infectious Diseases, 26(1), pp.85–90.

Workowski, K.A. and Bachmann, L.H. (2021).Sexually transmitted infections treatment guidelines, 2021.MMWR Recommendations and Reports, 70(4), pp.1–187.

Workowski, K.A. and Bolan, G.A. (2015).Sexually transmitted diseases treatment guidelines, 2015.MMWR Recommendations and Reports, 64(RR-03), pp.1–137.

Yusuf, H. & Trent, M., 2023.Pelvic Inflammatory Disease. In: StatPearls. Treasure Island (FL): StatPearls Publishing.

1. Zeyneloglu, H.B., Arici, A. and Olive, D.L. (1998). Adverse effects of hydrosalpinx on pregnancy rates after in vitro fertilization-embryo transfer. Fertility and Sterility, 70(3), pp.492–499.