ORIGINAL RESEARCH

Prevalence of Endometriosis in Sub-Fertile Women Confirmed at Laparoscopy: A Retrospective Analysis

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Abstract

Introduction: Endometriosis is a chronic, estrogen-dependent gynecological condition affecting approximately 3-10% of women of reproductive age [1]. The prevalence in infertile population could be up to 50% [2]. Laparoscopy is considered as the gold standard for diagnosing endometriosis. However, its invasive nature limits its routine use and currently limited to women symptomatic of endometriosis. Advance imaging techniques such as MRI, enhances the detection rate of deep infiltrating endometriosis but not as much for superficial/peritoneal endometriosis. This study aims to explore the prevalence of endometriosis in a sub-fertile population undergoing diagnostic laparoscopy.

Methods: This retrospective study was conducted at Nottingham University Hospital between 01/07/2022 and 01/08/2023. Women who were referred from fertility and benign gynaecology clinics for laparoscopy and dye testing were included. The diagnosis of endometriosis was confirmed based on visual findings during laparoscopy. Patient characteristics, including age, BMI, type and reasons for subfertility, and laparoscopy finding were analysed.

Results: A total of 100 women were included in the study, with the average age of 33.09 years in the endometriosis group. The prevalence of endometriosis within this cohort was found to be 55.34%, with 57 out of 100 women diagnosed. The subgroup (Endometriosis (Group 1) and other causes of sub-fertility (Group 2) analysis revealed a higher prevalence of endometriosis in women with primary infertility (3^6 vs. 21; p < 0.05). No significant differences were found between the demographic characteristics of the two groups including BMI or age (p = 0.709, p = 0.323). Out of 40 women who were initially thought to have unexplained infertility, 28 were found to have mild/moderate endometriosis in diagnostic laparoscopy.

Conclusion: This study highlights a high prevalence of endometriosis (55.34%) among women undergoing diagnostic laparoscopy and dye testing. High prevalence of endometriosis in unexplained infertility emphasizes the importance of early diagnosis and intervention in improving reproductive outcomes. Further research is needed to examine the role of laparoscopy in different populations and to explore the broader implications of endometriosis in fertility management.

Keywords

Endometriosis, Laparoscopy and dye test, Fertility evaluation, Prevalence, Unexplained infertility.

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Introduction

Endometriosis is a chronic, estrogen dependent inflammatory condition characterized by the growth of endometrium-like tissue, outside the uterine cavity. These ectopic tissues respond to the hormonal changes, causes proliferation, inflammation and scarring. This leads to pain, adhesions, and potential fertility impairments. It can involve various pelvic and extra-pelvic organs, including ovaries, fallopian tubes, ureter and bowels. It may result in a variety of systemic symptoms depending on the extent of disease, which includes chronic pelvic pain, dysmenorrhea, dyspareunia, dyschezia and infertility. Epidemiological studies estimate that endometriosis can affect 3 - 10% of women of reproductive age group [1]. Despite its prevalence, the pathophysiology of this disease is not fully understood, especially when it comes to how it impacts fertility. Up to 50% of women with infertility may have endometriosis, though the exact mechanisms of the association between these two conditions are complex and involve several factors [2].

Infertility is defined as the inability to conceive after one year of unprotected intercourse. It affects a significant proportion of couples worldwide. There are various causes of infertility, and about 15 - 30% of couples are labelled as unexplained infertility after initial diagnostic tests. These tests typically include assessments of ovulatory function, ovarian reserve, tubal patency, and semen analysis. While, some cases of unexplained infertility can be attributed to peritoneal factors such as subtle endometriosis or adhesions, diagnosing these conditions remains challenging. Laparoscopy with dye testing has long been considered the gold standard for diagnosing peritoneal factors, especially in cases of unexplained infertility that are accompanied by other symptoms like pelvic pain, dysmenorrhea, and heavy periods [3,4].

Over the past two decades, advancements in imaging techniques, such as 2D/3D trans-vaginal ultrasound and MRI, have decreased the use of diagnostic laparoscopy due to their non-invasive nature. However, these methods continue to face challenges in detecting early stages of endometriosis and subtle pelvic pathology [2]. Despite these improvements and wide availability of imaging methods, the possibility of missed or delayed diagnoses of peritoneal endometriosis remains. It is hypothesized that undiagnosed endometriosis may be a contributing factor to continued sub-fertility in these patients [5].

Endometriosis is found in up to 50% of women struggling with subfertility, with its association involving complex and multifactorial mechanisms[2]. These factors include distortion of the normal anatomy of the pelvis including pelvic organs, altered peritoneal environment, impaired egg quality, and immunological factors. Although, endometriosis is commonly present in women with unexplained infertility, but it can also be a contributing factor in those with tubal disease and male infertility. Studies have shown that women with endometriosis, especially those with moderate to severe forms, experience a significant reduction in fecundity compared to those without this disease [5]. Moreover, many women with the condition may not show any symptoms, with infertility often being the first sign of the disease [6,7]. The identification of endometriosis in women with infertility not only aids in explaining the cause of infertility but also provides opportunities for targeted treatment strategies that may improve reproductive outcomes. Early diagnosis and timely intervention will not only enhance the fertility outcomes but also improve the quality of life of the affected women.

The aim of this retrospective study is to investigate the prevalence of endometriosis in women population undergoing laparoscopy with dye test between 01/07/2022 and 01/08/2023. Our findings provide valuable insight into the link between endometriosis and infertility, emphasizing the crucial role of laparoscopy in diagnosing this condition in patients facing a range of fertility issues.

Materials and Method

This retrospective study was conducted at Queens Medical Centre, Nottingham university hospitals over the period from 01/07/2022 to 01/08/2023. The study included women who underwent diagnostic laparoscopy with dye test as a part of their fertility evaluation or along-with other planned laparoscopic procedure for various gynaecological conditions. These patients were listed for surgery from two main sources: the fertility clinic and the general benign gynaecology clinic.

Women referred from the fertility clinic had either experienced failed or negative hysterosalpingography (HSG) results or had symptoms of gynaecological conditions such as chronic pelvic pain, heavy painful periods in addition to sub-fertility. Additionally, some women were referred from the general benign gynaecology clinic for laparoscopy for conditions like chronic pelvic pain, fibroids, or suspected endometriosis whilst desiring fertility in near future. Their tubal patency was assessed at the same time as a part of a fertility evaluation, either due to a history of infertility or because they were planning to conceive in the near future.

Patients referred from the fertility clinic were initially reviewed by a consultant, who conducted a thorough medical and reproductive history assessment. In the absence of other gynaecological symptoms, they had HSG as their initial test for tubal patency. Patients who had negative or inconclusive results or were unable to tolerate the procedure were counselled thoroughly if they needed the laparoscopy with dye testing for further evaluation. A written informed consent was

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obtained prior to the operation. The consent process included details of the procedure, potential risks, and the benefits of the procedure. After the procedure, patients were reviewed at the fertility clinic to discuss further management options based on the laparoscopy findings.

The laparoscopic procedure was carried out under general anesthesia. During the procedure, a 360-degree diagnostic laparoscopy was carried out and the pelvic organs were examined for any signs of pathology. Methylene blue dye was introduced into the uterus to evaluate tubal patency, and its passage through the Fallopian tubes was carefully observed. If the dye passed freely into the peritoneal cavity, the tubes were considered patent. Blocked tubes or other abnormalities were documented accordingly. We specifically included patients who underwent laparoscopy with dye testing to select the infertile population among women undergoing benign gynaecology surgery, ensuring that we did not miss patients who had the procedure outside the fertility theatre list.

The diagnosis of endometriosis was based on visual findings during laparoscopy, with the extent and location of lesions documented. The severity of endometriosis was classified using the American Society for Reproductive Medicine (ASRM) system, which categorizes the condition from minimal to severe based on the size and location of lesions, as well as the extent of pelvic involvement.

Data collected from patient records included age, BMI, ethnicity, medical history, duration of infertility, primary or secondary infertility, and indications for laparoscopy, laparoscopy findings, and the stage of endometriosis. The prevalence of endometriosis was assessed based on the number of women diagnosed during laparoscopy, and its severity was analyzed across different patient subgroups. Descriptive statistics were used to explore patient characteristics and the overall prevalence of endometriosis. Comparisons between subgroups were made using appropriate statistical tests.

Results

A total of 100 patients were included in this study, who underwent diagnostic laparoscopy with a dye test as a part of their fertility evaluation. Endometriosis was present in 57 out of 100 patients, giving an overall prevalence of 55.34%.

Demographic criteria

Age: The mean age of patients in Group 1 (Endometriosis Group) was 33.09 years, ranging from 21 to 42 years, while Group 2 (No Endometriosis) had a mean age of 33.51 years, with age ranging from 23 to 44 years. The analysis showed no significant difference in the average ages between the two groups (p = 0.709) (Table 1).

BMI: The mean BMI of patients in Group 1 (Endometriosis Group) was 27.36 +/- 6.04kg/m², while Group 2 (No Endometriosis) had a mean BMI of 26.72 +/- 6.19 kg/m². The statistical analysis showed no significant difference in the average ages between the two groups (p = 0.323), suggesting that their BMI levels were similar (Table 2).

Ethnicity: The data suggests that the ethnic distribution was similar between the two groups, with no significant differences found (Table 3).

Primary or secondary sub-fertility: For primary and secondary sub-fertility, the available data indicated that the Endometriosis group (Group 1) had 36 patients with primary sub-fertility and 14 with secondary sub-fertility, while the group with other causes of sub-fertility (Group 2) had 21 patients with primary sub-fertility and 14 with secondary sub-fertility. The statistical comparison yielded a p-value of 0.25, indicating that there was no significant difference in the distribution of primary and secondary sub-fertility between the two groups. However, on sub-group analysis, women with primary subfertility showed a significant prevalence of endometriosis (36 vs. 21 - p value 0.25) (Table 4).

Duration of sub-fertility: Duration is quite variable from both groups ranging from 2 years to 18 years and hence non-comparable.

Causes of sub-fertility in Group 2: For Group 2 the sub-fertility factors were as follows: 28 patients had tubal factor-related sub-fertility diagnosed on HSG or ultrasound. 40 patients were thought to have unexplained infertility to begin with, out of which 28 were found to have endometriosis during the laparoscopy, leaving 12 patients as unexplained infertility. 2 patients had uterine polyp-related sub-fertility. These factors were considered when evaluating the possible causes of sub-fertility in this group (Table 5).

Table 1: Comparison of Age amongst the two groups.

Group	Mean age (years)	SD	p-value (t-test)
Endometriosis (Group 1)	33.4	5.8	0.709
Other causes of sub-fertility (Group 2)	32.4	5.7	

Table 2: Comparison of BMI amongst the two groups.

Group	Mean BMI (kg/m²)	SD	p-value (t-test)
Endometriosis (Group 1)	27.36	6.04	0.323
Other causes of sub-fertility (Group 2)	26.72	6.19	

Table 3: Ethnicity distribution amongst the two groups.

	Group 1	Group 2
White British	24	23
Brown Asian	6	6
Other white	3	4
Black African	1	2

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Table 4: Comparison of type of sub-fertility amongst the two groups.

Group	Primary	Secondary	p-value (t-test)
Endometriosis (Group 1)	36	14	0.25
Other causes of sub-fertility (Group 2)	21	14	

Table 5: Comparison of causes of sub-fertility amongst the two groups.

Cause of sub-fertility	Number of patients
Tubal factor	28
Unexplained	12
Ovarian cyst/dermoid	2
Endometrial polyp	1

Discussion

Our study's prevalence of endometriosis (55.34%) aligns with findings from Devabhaktuni, et al. who reported a prevalence of 52.17% in women undergoing laparoscopy for infertility, reinforcing the high prevalence of endometriosis in this population. Similarly, Calhaz-Jorge, et al. reported a prevalence of 45% in a large cohort of infertile women, a figure comparable to our study [8]. In contrast, Mahmood and Templeton found a prevalence of 21% in women undergoing laparoscopy for infertility, 15% in those with chronic abdominal pain, and 6% in women undergoing laparoscopic sterilization [9]. The relatively higher prevalence in our study may be attributed to the selective nature of the cohort, which predominantly includes women with suspected infertility or pain syndromes. Moreover, as prevalence estimates are influenced by symptom presence and diagnostic methods, the true prevalence of endometriosis may be underestimated when asymptomatic cases remain undetected, as highlighted in a systematic review by Parazzini, et al. which estimated a prevalence of 33.5% in women undergoing surgery for benign gynaecological conditions and 23.8% in infertile women [10].

The mean age of our patients with endometriosis (33.09 years) is consistent with the reproductive age range typically associated with the condition. Bosteels, et al. emphasized the importance of laparoscopy in diagnosing endometriosis in women within the reproductive age group, particularly those with fertility concerns, while Kristjansdottir, et al. reported that the actual age at diagnosis ranged from 16 to 69 years, with a mean of 35.9 years[11,12]. For histologically verified cases, the mean age was 38.9 years. The study also revealed that most diagnoses occurred in women aged 30 - 34 years.

Our study highlights the strong association between primary infertility and endometriosis. Consistent with findings by Calhaz-Jorge, et al. women with primary, women with primary subfertility have a higher risk of endometriosis compared to those with a history of previous pregnancies [8]. The study revealed that the risk of endometriosis was significantly lower in women with a prior pregnancy, with the risk decreasing in a 'dose-dependent' manner as the number of previous pregnancies increased. Specifically, 36% of women with primary subfertility had grade I/II endometriosis, compared to 31% in women with a history of pregnancy but no delivery, and 19% in women with a history of delivery. In our study, we found that significantly higher proportion of women with endometriosis presented with primary infertility (36%) compared to 14% with secondary infertility, reinforcing the negative impact of endometriosis on fertility.

Laparoscopy plays a crucial role in diagnosing endometriosis, especially in women struggling with infertility. Although other diagnostic methods, such as ultrasound and MRI, have shown promise, laparoscopy remains unmatched in its ability to directly visualize and confirm the presence of endometriotic lesions, especially in cases of mild to moderate endometriosis. According to Bosteels, et al. diagnostic laparoscopy and surgical treatment of minimal or mild endometriosis increases the spontaneous pregnancy rate in infertile women [11]. Their study emphasized that laparoscopy not only aids in diagnosis but also allows for the immediate treatment of endometriosis through excision or ablation. Study by Devabhaktuni, et al. reinforced the similar findings that adequate surgical treatment by laparoscopy in women with endometriosis would improve the conception rates. Diagnosis of endometriosis as well as management should be planned at the first laparoscopy to provide the maximum benefit to the patient [13]. Calhaz-Jorge, et al. developed a predictive model based on medical history for risk assessment for endometriosis in a sub-fertile women, allowing for early diagnosis and timely intervention of endometriosis by laparoscopy potentially improving reproductive outcomes [8].

Despite advancements in imaging methods, such as transvaginal ultrasound, which has been shown to detect ovarian endometriomas, laparoscopy remains indispensable, particularly in diagnosing more subtle forms of endometriosis like deep infiltrating disease [14]. Therefore, the value of laparoscopy in diagnosing endometriosis in the sub-fertile population cannot be overstated, as it provides both a definitive diagnosis and the potential for immediate surgical treatment, which is crucial in improving fertility outcomes. Prospective studies evaluating the efficacy of laparoscopic management in improving fertility outcomes, both for mild and severe diseases, are essential to guide clinical decision-making and optimize patient care.

Conclusion

In conclusion, this study highlights the high prevalence of endometriosis (55.34%) in women undergoing diagnostic laparoscopy and dye test as a part of their fertility evaluation. This aligns with existing literature showing the high prevalence of endometriosis in infertile populations.

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Despite the limitations of our study, such as the potential selection bias of our cohort and small sample size, our results offer valuable insights into the prevalence and clinical presentation of endometriosis in women with fertility concerns. Overall, our findings reinforce the importance of early and accurate diagnosis of endometriosis in women struggling with infertility. Further research, including larger, more diverse populations, is required to fully understand the impact of endometriosis on fertility and to optimize diagnostic and treatment strategies for affected women.

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