

Original Article

Comparison of the Prevalence of Adhesions at the time of Diagnostic Laparoscopy for Infertility between Patient who had open Myomectomy and those who had no Previous Pelvic-abdominal Surgery or Pelvic Inflammatory Disease

Jl Ikechebelu^{1,2,3}, GU Eleje^{1,2}, NN Joe-Ikechebelu⁴, CD Okafor², AO Akintobi⁵

¹Department of Obstetrics and Gynecology, Effective Care Research Unit, Nnamdi Azikiwe University, ²Department of Obstetrics and Gynecology, Nnamdi Azikiwe University Teaching Hospital, ³Life Institute for Endoscopy, Division of Life Specialist Hospital Limited, Nnewi, ⁴Department of Community Medicine, Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Amaku, Awka, ⁵Department of Obstetrics and Gynecology, Asokoro District Hospital, Abuja, Nigeria

Date of Acceptance:
09-Jul-2018

INTRODUCTION

Myomectomy has become one of the most common gynecological operations worldwide.^[1-3] Although open myomectomy is performed commonly for women with symptomatic leiomyoma desiring future fertility, operative laparoscopy should be the gold standard of surgical management of fibroids in women who meet certain criteria depending on surgeon expertise and local health care provision.^[4,5] Most of the time, these women present late when the fibroids are not amenable to laparoscopic surgery, and even when they present early,

they may not afford the costs of such minimal assess surgery owing to their limited resources. Subsequently, the post-operative adhesions may block tubal patency,

Address for correspondence: Dr. GU Eleje, Effective Care Research Unit, Department of Obstetrics and Gynaecology, Nnamdi Azikiwe University, Awka (Nnewi Campus), P.M.B. 5001 Nnewi, Anambra State, Nigeria.
E-mail: georgel21@yahoo.com

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How to cite this article: Ikechebelu JI, Eleje GU, Joe-Ikechebelu NN, Okafor CD, Akintobi AO. Comparison of the prevalence of adhesions at the time of diagnostic laparoscopy for infertility between patient who had open myomectomy and those who had no previous pelvic-abdominal surgery or pelvic inflammatory disease. Niger J Clin Pract 2018;21:1415-21.

ABSTRACT

Objective: The aim of this study is to determine the prevalence and patterns of adhesions in infertile women with prior open myomectomy compared with women without prior pelvic-abdominal surgery. **Methods:** A nested case-control study of infertile women who had diagnostic laparoscopy after open myomectomy between January 2008 and June 2015 in Life Institute for Endoscopy Limited, Nnewi Nigeria, was conducted. At diagnostic laparoscopy, the presence, site, and quality (density) of adhesions was noted and recorded. Women with endometriosis and documented prior pelvic infections were excluded. **Results:** Of the 348 women who were eligible, 121 women had prior open myomectomy (study group) while 227 had none (control group). Of the 121 women, adhesions were detected in 97 women; thus, the prevalence of adhesion after open myomectomy was 80.2% versus 20.3% (46/227) in controls (odds ratio [OR] =15.90; 95% confidence interval [CI] =8.86–28.76; $P < 0.001$). Compared with controls, adhesions were statistically higher in these sites: uterus (68.6% vs. 14.5%), fallopian tubes (77.7% vs. 16.7%), ovaries (62.8% vs. 20.3%), cul-de-sac (66.1% vs. 16.3%), bladder (45.5% vs. 7.9%), and bowel (53.7% vs. 6.2%) ($P < 0.001$, for all). Cohesive form of adhesions was also statistically higher, 54 (44.6%) vs. 32 (14.1%) ($P < 0.05$). **Conclusion:** In infertile women, post-open myomectomy adhesions have a high prevalence of 80.2% with high predilection in fallopian tubes and uterus, compared with women without prior abdominopelvic surgery at 20.3%. Cohesive form of adhesion predominates.

KEYWORDS: Infertility, intra-abdominal adhesions, laparoscopy, myomectomy, women

Access this article online

Quick Response Code: 	Website: www.njcponline.com
	DOI: 10.4103/njcp.njcp_39_17

envelope the ovaries, and prevent the eggs from having access to the open ends of the tubes at ovulation and/or cause pelvic pain that could encumber coital frequency. These adhesions could have significant implications in terms of morbidity and infertility and could also lead to medicolegal claims.^[6-8]

One study reported that 93.7% of women undergoing open myomectomy form pelvic adhesions.^[9] To minimize these myomectomy-related adhesions, intra-operative utilization of anti-adhesion agents has been tried.^[1,10] Recently, the Anti-Adhesions in Gynecology Expert Panel (ANGEL) have developed an adhesion risk score to provide a simple tool that will enable gynecological surgeons to routinely quantify the risks of post-surgical adhesions in individual patients.^[11] This will allow better informed use of available resources to target preventive measures, to minimize post-surgical adhesions, providing improved justification and targeting of the use of adhesion-reduction agents.^[11-15]

Thus, post-operative adhesions in infertile women with prior open myomectomy are of great concern. For women with prior open abdominopelvic surgery, the presence of adhesions could lead to added morbidity with increased risk of bowel injury if further surgery is required. The aversion for open myomectomy in an infertile couple is also of concern as the resulting intraperitoneal adhesions could worsen their problem of infertility.^[16] It is also of concern for all practicing gynecologists. In some cases, women may have adhesions even in the absence of prior abdominopelvic surgeries. The norm is to remove as many leiomyomas as possible to reduce the likelihood of fibroids recurrence, but this could be at the expense of an increased risk of post-operative adhesions.

Although there are published works on abdominopelvic adhesions following open surgical procedures, reported rates of adhesions varied from 34.0%,^[3] 40.6%,^[17] 50%,^[18] to 93.7%.^[9] The prevalence and patterns of post-open myomectomy adhesions have remained largely uninvestigated and much less is known about their impact on the subsequent fertility outcomes especially in the developing country settings.

The primary aim of this study was to determine the prevalence of post-open myomectomy adhesions as evaluated by direct laparoscopic observation among infertile women. The secondary aim was to compare the prevalence of adhesions in patients with prior open myomectomy and those without previous abdominopelvic surgery to determine the potential usefulness of routine adhesion risk score and adhesion prevention.

MATERIALS AND METHODS

The ethics review board of the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, approved the study. All women participating in this study provided written consent for the research and for laparoscopy.

The study site was the Life Institute for Endoscopy Limited, Nnewi, a private specialist hospital which has up to 50 bed capacity and offers varied services including laparoscopic surgery and assisted reproduction. Attendance to the hospital is via self-referral, and referral from both public and private hospitals. We started performing diagnostic laparoscopy at our hospital/center in 2002 and established a standardized surgical procedure in 2004.

In this nested case-control study, data from infertile women who had diagnostic laparoscopy after open myomectomy between January 2008 and June 2015 at the Life Institute for Endoscopy Limited, Nnewi, Nigeria, were assessed for the prevalence and patterns of intra-abdominopelvic adhesions. The patients were referred to this hospital for infertility work-up, and so the open myomectomies were not carried out in the institution of study. The indications for open myomectomy included symptomatic leiomyomas, a wish to preserve fertility/uterus, and/or ineligibility for other treatment options such as laparoscopic or hysteroscopic myomectomy. All patients with documented removal of at least one leiomyoma via previous open myomectomy were included.

The control group consisted of infertile women without prior open myomectomy seen during the same time period in the same hospital and who had diagnostic laparoscopy. Women with documented prior pelvic infections, endometriosis, and gynecological malignancy, and those that had any prior abdominopelvic surgeries other than open myomectomy were excluded.

For sample size calculation, the authors considered a difference in adhesion rate between two populations of 21.0% to be clinically significant. A power calculation using Epi Info 2008 version 3.5.1 (Centers for Disease Control and Prevention, Atlanta, GA) verified that based on the prevalence of adhesion (40.6%) in a prior study by Ikechebelu *et al.*^[17], a sample size of 341 (114 and 227 patients) was required to detect a 21% difference in adhesion rate between the prior myomectomy and no prior myomectomy groups at laparoscopy in a 1:2 ratio, respectively, with a power of 80% and an alpha error of 0.05. To account for 10% attrition (exclusions) rate, the authors decided to recruit 389 patients in the study.

The same surgeon applied the standard laparoscopic procedure, as described below, to all of the patients included in this study. The authors used the single-puncture technique under general anesthesia induced with ketamine using face mask and 100% oxygen ventilation.^[19]

All the laparoscopies were performed by the lead author (J.I.I.). Diagnostic laparoscopy proceeded as described, using a 10 mm laparoscope (Karl Storz, Tuttlingen, Germany) under general anesthesia. Closed-access techniques were used for all patients as the primary entry approach. Pneumoperitoneum was achieved with carbon dioxide insufflation through a Veress needle introduced via a standard superior approach or a Palmer's point entry approach (where there is a sub-umbilical midline scar) or inferior (where there is no previous scar) umbilical crease incision. The initial "stab" incision is then extended to 10 to 12 mm before introduction of the trochar/cannula. The laparoscope which was connected to a camera for video monitoring and light source was then introduced to view the abdominal and pelvic organs. Tubal patency was tested using methylene blue dye injected via an uterine cannula fitted into the cervix. During the laparoscopy, the abdominal cavity was inspected for presence of adhesions. Any adhesion involving the pelvic organs, prior site of skin incision, and peritoneum was assessed. Wound adhesion severity was classified as follows: 0,

none; 1, filmy; 2, dense; and 3, cohesive.^[14] In some patients, adhesiolysis was performed thereafter.

The primary outcome measures include the frequency of adhesion and sites of adhesion, while the secondary outcome measure is the severity of adhesions. All statistical analyses were performed using Epi Info 2008 version 3.5.1 and Stata PASS version 10.0 (NCSS; Kaysville, Utah, USA). The distribution of continuous variables was checked for normality. Unpaired *t* test was used to compare continuous variables. Univariate analysis was done using Fisher's exact test to compare categorical variables. The data are expressed as mean ± SD or number (percentage). The odds ratios (ORs) and 95% confidence intervals (CIs) were also calculated. A *P* value of <0.05 was considered statistically significant.

RESULTS

During the study period, 389 women were assessed for eligibility but 348 met the inclusion criteria. Of the 348 women that met the inclusion criteria, there were 121 women in the study group and 227 in the control group. The flow pattern is shown in [Figure 1]. The mean age of the patients with prior open myomectomy was 37.7 ± 3.6 years, and in the control group, the mean age was 34.9 ± 3.1 years (*t* = -0.72, *P* = 0.47). The age, type, and duration of infertility and severity of adhesion characteristics of the women are shown in [Table 1].

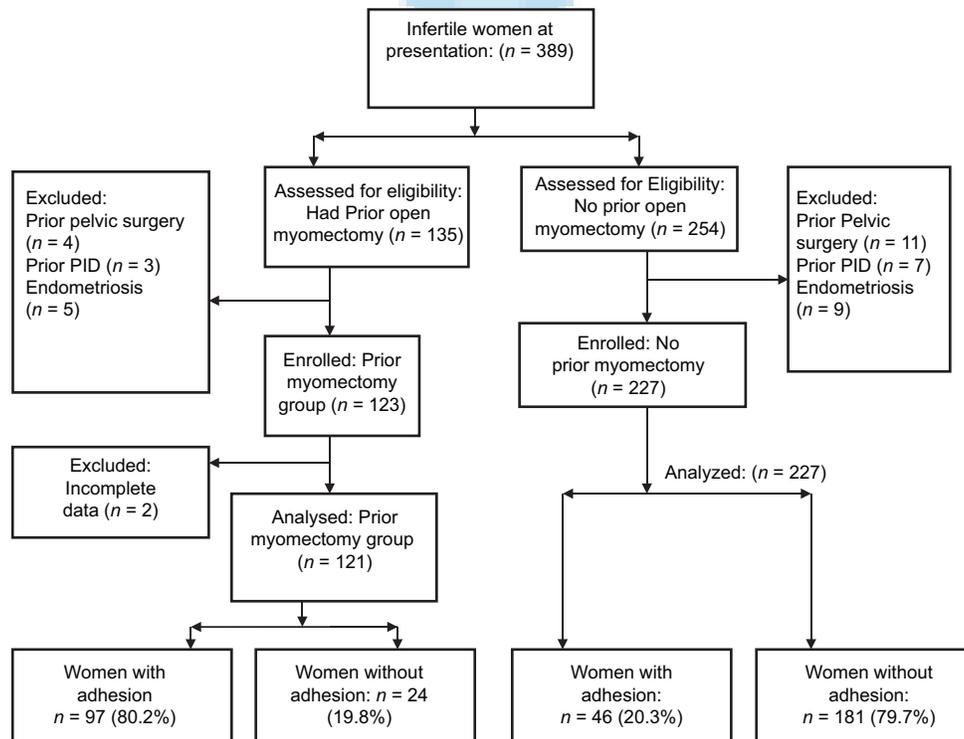


Figure 1: Flow chart showing the number of women with adhesion with or without prior open myomectomy

Table 1: Age, infertility, and severity of adhesion characteristics of the patients

Variables/subgroup	Prior myomectomy (n=121)	Without prior myomectomy (n=227)	OR (95%CI)	P
Mean age	37.7±3.6 years	34.9±3.1 years		0.119
Type of infertility				
Primary	48 (39.7%)	123 (54.2%)	0.55 (0.36-0.87)	*0.007
Secondary	73 (60.3%)	104 (45.8%)		
Duration of infertility				
≤5 years	58 (47.9%)	137 (60.4%)	0.60 (0.39-0.94)	*0.018
>5 years	63 (52.1%)	90 (36.6%)		
Extent of adhesion				
None	24 (19.8%)	46 (20.3%)		
Filmy	20 (16.5%)	89 (73.6%)	2.32 (1.10-4.92)	* 0.025
Dense	23 (19.0%)	60 (26.4%)	1.36 (0.65-2.87)	0.482
Cohesive	54 (44.6%)	32 (14.1%)	0.31 (0.15-0.63)	*0.007

OR=Odds ratio; CI=Confidence interval; *=significant

Table 2: Location of adhesion in the two groups

Structure	Prior myomectomy (%) (n=121)	Without prior myomectomy (%) (n=227)	OR (95% CI)	P
Uterus				
Adhesion	83 (68.6%)	33 (14.5%)	12.84 (7.54-21.87)	<0.001
No adhesion	38 (31.4%)	194 (85.6%)		
Fallopian tubes				
Adhesion	94 (77.7%)	38 (16.7%)	17.31 (9.97-30.07)	<0.001
No adhesion	27 (22.3%)	189 (83.3%)		
Ovaries				
Adhesion	76 (62.8%)	46 (20.3%)	6.64 (4.07-10.85)	<0.001
No adhesion	45 (37.2%)	181 (79.7%)		
Cul-de-sac				
Adhesion	80 (66.1%)	37 (16.3%)	10.02 (5.98-16.78)	<0.001
No adhesion	41 (33.9%)	190 (83.7%)		
Bladder				
Adhesion	55 (45.5%)	18 (7.9%)	9.68 (5.31-17.62)	<0.001
No adhesion	66 (54.5%)	209 (92.1%)		
Bowel				
Adhesion	65 (53.7%)	14 (6.2%)	17.66 (9.23-33.77)	<0.001
No adhesion	56 (46.3%)	213 (93.8%)		

OR=Odds ratio; CI=Confidence interval

Majority, 301/348 (86.5%), of women in this study had normal menstrual periods.

Of the 121 women in the post-myomectomy group (cases), adhesions were detected in 97; thus, the prevalence of adhesion after open myomectomy was 80.2% versus 20.3% (46/227) in the controls (OR = 15.90; 95% CI = 8.86–28.76; $P < 0.001$). [Table 2] shows the location of adhesions in the two groups. Adhesions at the uterus, fallopian tubes, ovaries, cul-de-sac, bladder, and bowel were statistically higher in women with prior open myomectomy than for controls ($P < 0.001$, for all). Of the 121 women in the post-myomectomy group (cases), bilateral tubal occlusion were detected in 11; thus, the prevalence of

bilateral tubal occlusion after open myomectomy was 9.1% versus 2.2% (5/227) in the controls (OR = 4.44; 95% CI = 1.51–13.10; $P = 0.004$).

DISCUSSION

This study has revealed that the prevalence of adhesions following open myomectomy was 80.2% compared with 20.3% seen in women with no previous abdominopelvic surgery or pelvic inflammatory disease. These adhesions were statistically more frequent in prior open myomectomy group than for controls in the following sites: uterus (68.6% vs. 14.5%), fallopian tubes (77.7% vs. 16.7%), ovaries (62.8% vs. 20.3%), cul-de-sac (66.1% vs. 16.3%), bladder (45.5% vs. 7.9%),

and bowel (53.7% vs. 6.2%). Cohesive form of adhesions was also statistically more frequent (44.6%) in women with prior myomectomy than in controls (14.1%).

The observed high prevalence of adhesions was in accordance with the report of 93.7% in a study by Tulandi *et al.*^[9] Although our study group appears to have included more women with multiple myomas, our results were similar. The prevalence of adhesions after open myomectomy appears not to have changed remarkably despite advances in its prevention.^[13-15] This study has also revealed a statistically significant difference in the prevalence of bilateral tubal occlusion after open myomectomy ($P = 0.004$). In a multicenter, randomized study that investigated the efficacy of the hydrophilic resorbable film (anti-adhesion agent) in preventing postoperative adhesions following myomectomy, it was concluded that hydrophilic resorbable anti-adhesion film significantly reduced adhesion incidence and severity after laparotomic myomectomy.^[20]

The impact of open surgery on future fertility should be a concern for all reproductive surgeons. Being a rather major operation that involves manipulations of some intra-abdominal organs and tissues, postoperative adhesions are indeed expected following open myomectomy. Based on this expectation, an adhesion risk score was formulated for use in clinical practice.^[11] Cost considerations relative to effectiveness are paramount before deciding on routine use of anti-adhesion agents in clinical practice. A recent survey of adhesion awareness among gynecological surgeons in European hospitals concluded that anti-adhesion agents were too expensive to be used routinely in gynecological surgery.^[2,21] However, recent study has indicated the effectiveness of the anti-adhesion agents.^[20]

Hudecek *et al.*^[22] reporting on the second look laparoscopy findings in women with prior laparoscopic myomectomy compared with prior open laparotomic myomectomy found that in the prior open laparotomic myomectomy, there was significantly lower incidence of recidives of uterine fibroids observed by second look laparoscopy ($P = 0.0025$) and no significant difference of occurrence of postoperative adhesions compared with control group. A randomized control trial by Coddington *et al.*,^[23] involving 20 patients who had an initial abdominal myomectomy followed by a second-look laparoscopy, revealed that for every additional centimeter of incision length, the total adhesions area over the uterine serosal surface increased by 0.55 cm² ($P < 0.001$). In this study, intra-abdominal adhesions were found in 80.2% of cases where the women had prior open myomectomy and in 20.3% when they had not, a difference which reached statistical

significance. The high number of fibroids removed could be contributory, although this was not assessed in this study.^[24,25] The higher number of fibroids removed may give rise to more surface area of contact, and so there may be more adhesions.

In Nigeria, women present late for surgery with large and multiple myomas after failure of other treatment options.^[26,27] The norm is to remove as many leiomyomas as possible to make the uterus as “normal” as possible and to reduce the likelihood of recurrence, but it could be that this is at the expense of an increased risk of post-operative intra-abdominal adhesions. The possible growth of small fibroids left over at the time of myomectomy leads many surgeons to try and remove as many fibroids as possible, on the hope of sparing patients having to return to have them removed surgically.

In this study, the bowel was involved in the adhesions in 53.7% of women who had previous myomectomy, a finding which was in tandem with Menzies and Ellis^[28] study as well as Pittaway *et al.* study^[29] which showed that bowel was involved in about 50% of the cases. Although this study revealed a lower prevalence of 62.8% for the adhesions involving the ovaries, the highest (77.7%) prevalence of adhesion involved the fallopian tubes. This could be explained by the high susceptibility of the tubal and ovarian epithelium and its proximity to other peritoneal surfaces and myomectomy wounds.^[30] In the absence of myomectomy clamp, many surgeons utilize a Foley catheter as a tourniquet to control bleeding during open myomectomy, and so the tubes could be vulnerable if the catheter is passed around them.^[31]

Our study has also revealed that cohesive form of adhesions was seen in significant proportion in women with prior myomectomy ($P < 0.05$). This finding is consistent with a previous report by Tinelli *et al.*,^[15] where cohesive adhesions were more common after myomectomy without an adhesion barrier, whereas adhesions were mostly filmy or organized when an adhesion barrier was used.

The strength of this study is the large size of the study cohort. Also, this is the first study in Nigeria which has determined the real prevalence of adhesion following open myomectomy.

However, the limitations of this study should be taken into account when interpreting its results. This study was a nested case-control study, and so, we were unable to assess for intra-abdominal adhesions prior to myomectomy as these prior myomectomies were not performed in the study hospital. The adhesion risk score

could not be assessed too. It was also difficult to evaluate the operative technique used for the prior myomectomies and whether adhesion preventive approaches were used. In addition, the findings of this study may appear apparent from the onset as better control would have been patients who had pelvic-abdominal surgery apart from myomectomy.

CONCLUSION

In conclusion, based on our findings, intra-abdominal adhesions following open myomectomy in infertile women have a high prevalence of 80.2% with high predilection for the fallopian tubes and uterus, compared with 20.3% in infertile women with no prior abdominal surgery. There is a dire need for the development and utilization of effective, safe, and affordable anti-adhesion agents during open myomectomy, and they should be made to be readily available. Laparoscopic myomectomy is the preferred approach in those who present early and who can afford it.

Financial support and sponsorship

The study was basically funded by authors themselves. There were no external sponsors.

Conflicts of interest

There are no conflicts of interest.

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