

In Search for an Effective Conservative Surgery for Diffuse Adenomyosis in a Resource-Constrained Setting: Outcome of Open Double-Flap Adenomyomectomy in Infertile Women

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ABSTRACT

OBJECTIVES: Adenomyosis is a common cause of pelvic pain, menorrhagia, and infertility in women of reproductive age. There remains a need for an effective fertility-sparing surgical option for managing diffuse adenomyosis. This study evaluated the clinical and reproductive outcomes of open double-flap adenomyomectomy in infertile women in a resource-poor setting.

STUDY DESIGN: This prospective observational cohort study was conducted between July 2024 and December 2025. Twenty-four infertile women with diffuse adenomyosis underwent open double-flap adenomyomectomy and were followed up for 12 months. Clinical and postoperative outcomes were analyzed. The severity of menorrhagia and dysmenorrhea was assessed using a Visual Analog scale (VAS) serially over 12 months postoperatively. Reproductive outcomes were also evaluated in women who subsequently had assisted reproductive treatment.

RESULTS: The mean age of the women studied was 40.9±5.6 years, while the average duration of infertility was 7.4±3.4 years. The mean uterine size was 17.3±2.5 weeks. Mean blood loss was 285±222.9 ml, and 29.2% of the women required blood transfusion. The average duration of surgery was 135.9±75.6 minutes. One woman (4.2%) developed postoperative pelvic abscess. Appreciable improvement in menorrhagia and dysmenorrhea was observed, as demonstrated by declining VAS scores during follow-up. Nine women underwent in vitro fertilization, of whom 3 achieved pregnancy.

CONCLUSION: Double-flap open adenomyomectomy may result in symptom relief and appreciable fertility outcomes in women with diffuse adenomyosis. The procedure appears safe, with low complication rates, and may represent a valuable fertility-sparing surgical modality in resource-constrained settings.

Keywords: Adenomyosis; Dysmenorrhoea; Infertility; Menorrhagia, Open double-flap adenomyomectomy; Outcomes

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Introduction

Adenomyosis is a benign uterine condition that results from invasion of endometrial glands and stroma into the myometrium, resulting in an enlarged uterus with an altered architecture (1). Clinically, it commonly presents with menorrhagia, dysmenorrhea, and infertility (2). Among infertile women, the prevalence ranges from 7% to 27% (3). In a tertiary health institution in Nigeria, histological evidence of adenomyosis was identified in 34% of hysterectomy specimens (4). However, the true burden of this disease in sub-

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Saharan Africa remains poorly characterized due to under-diagnosis, symptom overlap with common conditions such as uterine fibroids, and limited imaging modalities (5).

Adenomyosis is increasingly recognized as one of the causes of infertility, especially in women of advanced reproductive age (6). The proposed mechanisms include obstruction of tubal ostia, disruption of uterine peristalsis and sperm transport, and altered endometrial function and receptivity (6,7). Adenomyosis has also been associated with reduced pregnancy and live birth rates following in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), as well as an increased risk of preterm births and abortions (8,9).

Medical treatment using hormonal and nonhormonal agents used in the management of adenomyosis relieves symptoms temporarily but rarely restores fertility (3,10). Surgical intervention is considered where medical management fails or where symptoms become severe (10,11). Although hysterectomy is the definitive treatment for adenomyosis, it is unsuitable for women who desire future fertility and is often declined due to cultural and emotional reasons (12). Several conservative uterus-sparing surgeries, including adenomyosis wedge resection and transverse-H incision, have been developed to reduce disease burden while preserving fertility (13). However, incomplete excision may result in persistent symptoms and high recurrence rates (14).

An ideal surgical modality for the treatment of diffuse adenomyosis should permit wide and near-complete excision of adenomyosis (14). The laparoscopic double-flap approach and triple-flap technique described by Osada have demonstrated favorable symptom control and fertility outcomes (15, 16). However, the triple-flap technique is technically demanding and may be associated with prolonged operating time and increased intraoperative blood loss (16). In many low-resource settings, access to advanced endoscopic surgery remains limited by high cost, lack of training, and infrastructural deficits (17,18). Consequently, open surgeries continue to represent a mainstay of gynaecologic surgery in resource-poor settings (19). Furthermore, laparotomy allows direct digital palpation and better delineation of adenomyotic tissues, thereby preventing inadvertent excision of normal myometrium (15).

Evaluating the outcomes of open double-flap adenomyomectomy is important for determining its feasibility, safety, and reproductive effectiveness in low-resource settings. This study aimed to assess the clinical and reproductive outcomes of open double-flap adenomyomectomy among infertile women with diffuse adenomyosis.

Material and Method

This was a prospective observational cohort study conducted at Alps Hospitals and Diagnostics, Jos, Nigeria, between July, 2024 and December, 2025. This study was ap-

proved by the ethics committee of the National Obstetric Fistula Center, Ningi, Bauchi State, Nigeria, on 17th July, 2024, with approval number NOFCN/GEN/035. It was conducted according to the principles of the Declaration of Helsinki. A total of 24 women who underwent open double flap adenomyomectomy for diffuse adenomyosis were recruited for this study. The inclusion criteria included women diagnosed with diffuse adenomyosis using abdominal or vaginal ultrasonography, women who desired uterine preservation, and women whose tissues were sent for histology and confirmed to be adenomyosis. The exclusion criteria included women who had completed childbearing, women with medical contraindications to surgery, and women who declined consent for open double-flap adenomyomectomy. All participants received detailed counseling about triple-flap adenomyomectomy and double-flap adenomyomectomy before surgery.

The demographic and clinical characteristics were entered into a Microsoft Excel spreadsheet designed for the study. The intraoperative findings were also recorded. After the surgery and discharge, the duration of admission was determined. The patients were followed up fortnightly for one month and then monthly for 3 months. At every visit, a clinical evaluation for menorrhagia and dysmenorrhea was performed via a visual analog scale. A paper with a horizontal line marked from 0 to 10 was provided. Zero represented no dysmenorrhoea/menorrhagia, and 10 represented the worst dysmenorrhea/menorrhagia. In doing so, the patient rated the postoperative menstrual flow against the preoperative level, which was considered 10 (worst). Each woman was asked to assess her symptom level by marking the intensity on the scale provided, and the score was recorded. The VAS scores at the 6th and 12th months were obtained via mobile phone. Women who were ready, fit, and desired conception were offered IVF treatment.

Data analysis was performed using Microsoft Excel version 365 (Microsoft Corporation, Redmond, WA, USA). Results were expressed as mean values with standard deviation and simple proportions.

Surgical Procedure: The procedure was performed in the supine position after subarachnoid block. The surgical technique is a modification of the triple-flap technique of adenomyomectomy by Osada et al (16). A transverse suprapubic incision or midline incision was made; the length depended on the size of the uterus. An examination of the pelvic cavity was performed, and relevant findings were recorded on the proforma. Gentle adhesiolysis was performed for those with pelvic adhesions. When the uterus was exteriorized, vasopressin 1:100 dilution was infiltrated into the uterine myometrium for hemostasis. The enlarged uterus was bisected with a scalpel from the serosal surface of the fundus, in the midline and in the sagittal plane, all the way down through the adenomyosis until the uterine cavity and the crucial landmarks of the endometrium were brought to a clear view (Figure 1).



Figure 1: Bisected uterus at the fundus

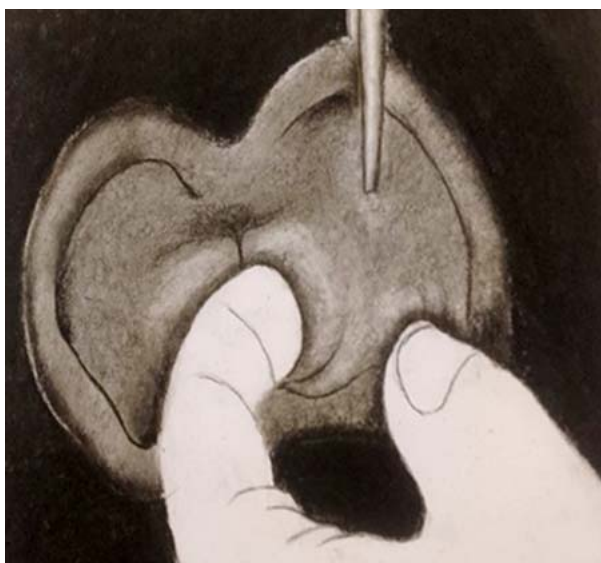


Figure 2: Endometrial cavity exposed to visualize the borders of the endometrium

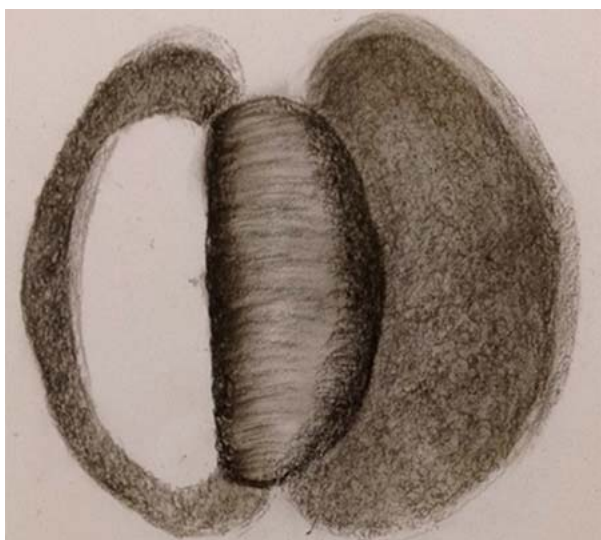


Figure 3: Adenomyotic tissues excised from the surrounding serosa and endometrium

The endometrial cavity was opened sufficiently to permit the introduction of the index finger to protect and help guide the extent of excision of the adenomyotic tissues (Figure 2). The adenomyotic tissues were grasped with Allis forceps and excised from the surrounding myometrium, leaving a myometrial thickness of 1 cm from the serosa above and 1 cm from the endometrium below (Figure 3). If the myometrium appeared normal, it was spared. The same procedure was repeated on the contralateral side. Care was also taken to avoid damage to the Fallopian tubes. After the adenomyotic tissues were excised, uterine reconstruction began with repair of the endometrium continuously with Vicryl 2-0 (Figure 4). Next, the serosa and myometrium of the bisected uterus were sutured via the double flap method. In doing so, the serosa of the left side of the bisected uterus was stripped up to the myometrium and then approximated over the endometrium with interrupted Vicryl 0 sutures (Figures 5 and 6). The right flap was then used to cover the surface of the stripped left flap such that only the myometrial tissues overlapped (Figure 7). This was then approximated with Vicryl 0, ensuring that suture lines did not overlap. Ovarian cystectomy was performed in patients with endometriomas.

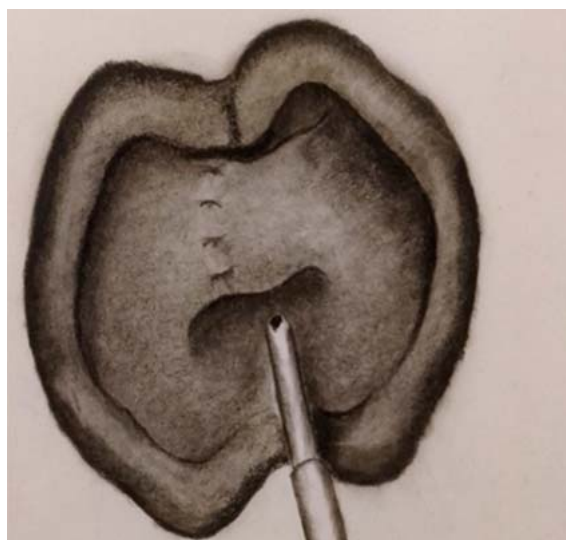


Figure 4: Repair of endometrium

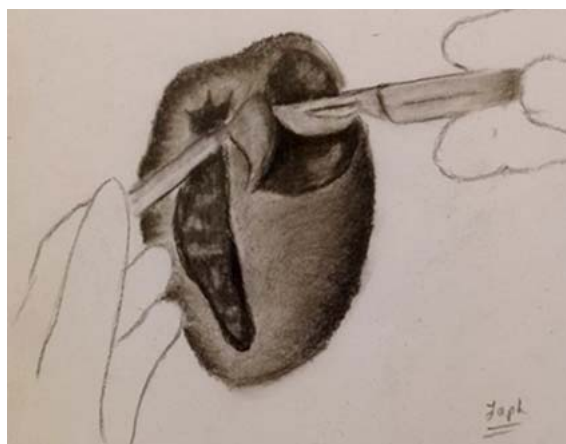


Figure 5: Stripping of the serosa of the left flap

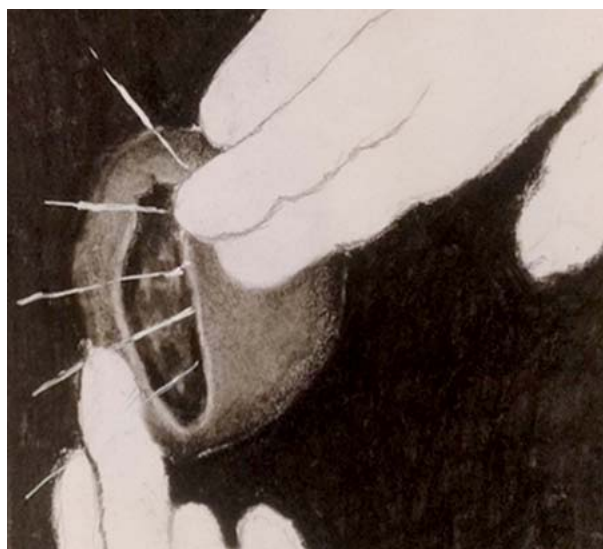


Figure 6: Flap with stripped serosa approximated over repaired endometrium

The peritoneal cavity was lavaged with normal saline, and the anterior abdominal wall was closed in layers. An 8-Fr Foley catheter was inserted into the uterine cavity and inflated with 3 mL of sterile water to prevent intrauterine adhesions. The duration of surgery was recorded. Intraoperative blood loss was calculated by adding the volume of blood collected in the suction system to that estimated from blood-soaked gauze, abdominal sponges, and drapes. Postoperatively, patients received antibiotics and analgesics. They were also administered oral estradiol to prevent intrauterine adhesions. Patients who developed postoperative complications were managed accordingly.

Results

This study revealed that all women experienced progressive relief of dysmenorrhea and menorrhagia with an unre-



Figure 7: Surface of the stripped surface covered by the contralateral unstripped flap

markable postoperative course. There was also significant improvement in fertility.

Open double-flap adenomyomectomy was performed on 24 women during the study period. The mean age of this cohort of women was 40.9 ± 5.6 years. Most of the patients (75%) were nulliparous. The mean duration of infertility was 7.4 ± 3.4 years. At presentation, 70.8% of the patients had dysmenorrhea alone. Most of the patients had uterine surgeries in the past; 37.5% had no history of prior uterine surgery. The other clinical characteristics are presented in Table I below.

The mean uterine size was 17.3 ± 2.5 weeks' gestation, with 12.5% of women having concomitant endometriosis. The mean intraoperative blood loss was 285.2 ± 222.9 mL, with 29.2% of women requiring blood transfusion. One (4.2%) patient had a pelvic abscess. The VAS score for menorrhagia decreased from 1.7 ± 1.4 in the first month to 0.9 ± 1.5 in the third

Table I: Clinical characteristics of the participants

Parameter	Value
Mean (SD) Age	40.9±5.6
Parity	
Nulliparous (%)	18 (75.0)
Para 1(%)	4 (16.7)
Para 2 and >	2 (8.3)
Mean (SD) Duration of infertility (Years)	7.4±3.4
Menstrual Symptoms	
Dysmenorrhea alone (%)	17 (70.8)
Menorrhagia alone (%)	0
Both Dysmenorrhea and Menorrhagia (%)	7 (29.2)
No Menstrual symptom	0
Previous surgeries (%)	
None	9 (37.5)
Caesarean Section only	2 (8.3)
Myomectomy only	12 (50.0)
Caesarean Section + Myomectomy	1 (4.2)

SD: Standard deviation

month and 0.8 ± 1.5 in the 6th and 12th months. The VAS score for dysmenorrhea showed a downward trend, from 1.0 ± 1.3 in the first month to 0.8 ± 1.4 in the third month, then plateaued at 0.9 ± 1.5 in the sixth and twelfth months. A total of 9 women out of 24 women were ready and had IVF postoperatively, and 3 women, representing 33.3% of the IVF population, had a positive pregnancy test. There were 2 miscarriages and 1 live birth. The other intraoperative findings and outcomes are shown in Table II below.

Discussion

The findings from this study reveal that open double-flap adenomyomectomy is feasible and effective in relieving menorrhagia and dysmenorrhea in women with adenomyosis and that the perioperative and postoperative morbidity rates are acceptable. It preserves uterine function with a reasonable fertility outcome.

The mean age (40.9 ± 5.6 years) of the study participants corresponded with the frequently reported age of diagnosis of adenomyosis (4,5). Nulliparous women constitute 75% of the women who have undergone this procedure. This may lend some credence to the association of adenomyosis with infertility (5). In our subregion, the evaluation and treatment of infertility is usually delayed (20), which is reflected in the long average duration (7.4 ± 3.4 years) of infertility at presentation. Additionally, the limited access to fertility specialists and imaging facilities, which delays evaluation and intervention, may account for this delayed presentation for fertility evaluation. It is worth noting that most of the women in this cohort

had dysmenorrhea alone or a combination of menorrhagia and dysmenorrhea, and the majority also had prior uterine surgeries. These findings align with the commonly reported symptoms of adenomyosis and previous uterine surgeries associated with adenomyosis (11).

The intraoperative finding of an average uterine size of 17.3 ± 2.5 weeks is consistent with reports by Osada et al (16). This large uterus also points to the chronicity of this condition and late presentation in our environment. The mean intraoperative blood loss was 285.2 ± 222.9 mL, and 7 of 24 patients received blood transfusion. The amount of blood loss seen in this method of adenomyomectomy is lower than that reported in the open triple flap method (16). The volume of blood loss in our method is also lower than that reported in open double flap adenomyomectomy done in ten women. We believe that careful surgical technique and the use of vasopressin to achieve hemostasis contributed to the reduced blood loss in our technique. The mean duration of surgery in this technique was 135.9 ± 75.6 minutes, which is shorter than that reported for open triple-flap technique by Osada and colleagues (16). The shorter duration in our study highlights the relative ease of this technique compared with the triple flap technique. A short-duration procedure is better suited for a low-resource setting where workforce and equipment for such prolonged anesthesia may not be readily available. However, this is longer than the 130-minute duration reported in a laparoscopically assisted double-flap technique (21). This variation may be due to the larger uterine sizes encountered in this study. Also, additional procedures such as adhesiolysis and excision of endometriomas in some patients likely contributed to the

Table II: Intraoperative findings and outcomes

Variable	Value
Mean (SD) Size of Uterus (Weeks)	17.3 ± 2.5
Concomitant Endometriosis (%)	3 (12.5)
Mean (SD) Blood Loss (mL)	285.2 ± 222.9
Mean (SD) Duration of Surgery (Minutes)	135.9 ± 75.6
Blood transfusion (%)	7 (29.2)
Pelvic Abscess (%)	1 (4.2)
Mean (SD) Duration of Hospital Stay (Days)	3.3 ± 1.3
Mean (SD) VAS Scores for Menorrhagia	
1 month	1.7 ± 1.4
3 months	0.9 ± 1.5
6 months	0.8 ± 1.5
12 months	0.8 ± 1.5
Mean (SD) VAS Scores for dysmenorrhoea	
1 month	1.0 ± 1.3
3 months	0.8 ± 1.4
6 months	0.9 ± 1.5
12 months	0.9 ± 1.5
IVF Treatment (N=9)	
Positive Pregnancy test	3 (33.3)
Miscarriage	2 (22.2)
Live birth	1 (11.1)
Negative pregnancy Test	6 (66.7)

SD: Standard deviation, IVF: In vitro fertilization, VAS: Visual analog scale

longer duration of surgery in this cohort. The finding of endometrioma in 12.5% of patients aligns with a previous study that showed that endometriosis coexists with adenomyosis in 10-25% of women (22,23).

The postoperative outcomes in these patients were favorable. The mean duration of hospital stay in this study was short (3.3 ± 1.3 days), and only one woman had a pelvic abscess. A longer duration of hospital stay of 7.3 ± 1.1 days was reported for laparoscopically assisted double-flap adenomyomectomy (21). The above findings further show that open double-flap adenomyomectomy is safe and reproducible in a low-resource setting such as ours, especially when performed by experienced surgeons. The visual analog scale scores for dysmenorrhea and menorrhagia suggest symptom improvement. These findings demonstrate the clinical effectiveness of the surgery. Wide adenomyotic excision with uterine reconstruction provides significant symptom relief with a low recurrence rate (16). Postoperatively, nine patients had in vitro fertilization, three had a positive pregnancy test, and one had a live birth. This fertility outcome is comparable to that in a series of conservative adenomyomectomies, where a postoperative conception rate of 20-45% and a live birth rate of 10-25% were reported (14,15). In this environment where access to assisted reproduction is limited and expensive, this modest improvement in fertility outcome following open double-flap adenomyomectomy is meaningful in view of the advanced age and long duration of infertility in these patients.

This procedure may be implemented in sub-Saharan Africa, where access to endoscopic expertise and facilities is limited. This is further supported by the findings in a report by Zhu et al., who reported the superiority of open double-flap adenomyomectomy over the laparoscopic technique for diffuse adenomyosis (15). This modified procedure appears to simplify the triple flap technique described by Osada and colleagues with similar and, in some cases, better outcomes (16). Although the advantages of the laparoscopic approach include fewer complications, less postoperative pain, and shorter lengths of surgery and hospital stay, radical resection of adenomyotic tissues may be technically challenging.

The prospective nature of this study is a major strength. This allows systematic follow-up and standardized assessment of postoperative outcomes over time. The focus of the study on infertile women with histologically confirmed adenomyosis improved diagnostic accuracy and reduced misclassification - the evaluation of both clinical and reproductive outcomes provided clinically relevant information for fertility-preserving management of diffuse adenomyosis. The study provided valuable evidence from a resource-constrained sub-Saharan African setting where data on conservative surgical management of adenomyosis are limited.

This study has limitations that are worth mentioning. This was a single-center study. This may reduce external validity

and limit applicability to other populations. The strength of the recommendation and generalizability are limited due to the small sample size used. The follow-up period was limited to 12 months, which precluded the determination of other long-term complications such as recurrence and uterine rupture during pregnancy. The reproductive outcome should be interpreted with caution as only 9 out of 24 women had IVF treatment, which significantly affected the power of recommendation.

In conclusion, open double-flap adenomyomectomy may be associated with significant symptom relief and appreciable fertility outcomes in women with diffuse adenomyosis. The procedure showed a reasonable degree of safety, and low complication rates were observed in these women. This procedure may represent a valuable fertility-sparing surgical modality in resource-constrained settings. We recommend a larger multicentered study with a longer follow-up period to confirm these preliminary findings.

Declarations Ethics approval and consent to participate:

All participants signed informed written consent before being enrolled in the study. This study was reviewed and approved by the ethics committee of the National Obstetric Fistula Center, Ningi, Bauchi State, Nigeria on 17th July, 2024 (approval number NOFCN/GEN/035). All procedures were performed in accordance with the principles of the Declaration of Helsinki.

Consent for publication: Written informed consent for publication of the data included in this study was obtained from all participants.

Availability of data and materials: The data supporting this study are available through the corresponding author upon reasonable request.

Competing interests: The authors declare that they have no competing interests.

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mal analysis, methodology, project administration, visualization, review and editing. Orjiani JC: Conceptualization, methodology, supervision, visualization, and editing. Odoh NP: Conceptualization, methodology, visualization, validation, review and editing. Ocheke AN: Conceptualization, methodology, visualization, validation, review and editing. All authors read and approved the final manuscript.

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