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Laparoscopic anterior resection of rectum for rectal deeply infiltrating endometriosis

A short-term prospective randomized trial

Yong-Ping Yang, MD[a], Ling-Yun Yu, MD[b], Jian Shi, MD PhD[a], Jian-nan Li, MD PhD[a], Min Wang, MD PhD[a,*], Tong-Jun Liu, MD PhD[a,*]

Abstract

Laparoscopic anterior resection of rectum (AR) is one of surgical approaches for deeply infiltrating endometriosis (DIE). Up to date, no clinical trials have clearly analyzed the short-term and long-term complications post-surgically, indications or feasibilities for surgical procedure, or post-operative recovery. The aims of this trial were to evaluate the indications for laparoscopic AR, the short-term and long-term complications post-surgically, post-operative recovery.

We conducted a prospective study of 29 patients. They were divided into 2 groups. The period of follow-up was 12 months post-surgery. In our study, we recruited patents with laparoscopic AR experiencing failure of medical treatment (3 months) or associated infertility (>2cycles). The operative data and short term and long term complications were recorded. The outcomes of laparoscopic AR group were assessed by questionnaires, such as NRS (numeric rating scale), KESS (Knowles-Eccersley-Scott Symptom Questionnaire), VAS (visual analogue scale), WCS (Wexner constipation score) and ABS (Abdominal Bloating Score), which were compared with the outcomes of medicine group at set time points of baseline, 3 months, 6 months, 9 months and 12 months. The overall outcomes of the two groups were assessed with 5-point Likert Scale.

Patients in surgery group were recovery rapidly without serious short term or long term complications. All of NRS, KESS, VAS, WCS, and ABS in surgery group were getting better greatly than that in medicine group (3.04 ± 1.91 vs 5.41 ± 3.01, 5.64 ± 1.54 vs 7.01 ± 1.03, 0.50 ± 0.38 vs 3.58 ± 2.01, 4.43 ± 1.02 vs 8.92 ± 2.45, and 0.61 ± 0.34 vs 1.42 ± 0.71) at 3 months post-operation. However, the advantage of surgery group was almost vanished at 12 months (4.02 ± 2.53 vs 5.99 ± 2.31, 7.42 ± 3.17 vs 10.98 ± 2.53, 1.59 ± 1.3 vs 2.23 ± 1.59, 6.01 ± 2.53 vs 7.90 ± 3.25, and 1.31 ± 1.05 vs 1.39 ± 1.02). Furthermore, we compared the overall outcomes between the 2 groups with 5-point Likert Scale, with confirmation of the advantage at 3 months post-surgically. Additionally, we compared these questionnaires, with the finding that VAS and 5-point Likert Scale of surgery group had the same changes. Finally, a table of indications for laparoscopic AR were tabulated according our clinical experience.

Patients can receive benefit from both medicine and laparoscopic AR. However, laparoscopic AR has obvious advantage of rapid symptom relief. Further studies and clinical data collections are required for indications and feasibility of combined therapy.

Abbreviations: ABS = Abdominal Bloating Score, AR = anterior resection of rectum, BM = bowel movement, BMI = body mass index, DIE = deeply infiltrating endometriosis, IMA = Inferior Mesenteric Artery, KESS = Knowles-Eccersley-Scott Symptom Questionnaire, LCA = Left Colonic Artery, NRS = Numerical Rating Scale, VAS = Visual Analogue Scale, WCS = Wexner Constipation Score.

Keywords: deeply infiltrating endometriosis, infiltrate the rectum, laparoscopic anterior resection of rectum, minimal invasion

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All data generated or analyzed during this study are included in this published article [and its supplementary information files].

[a] Department of General Surgery, the Second Hospital of Jilin University, [b] Department of Ear Nose and Throat Surgery, the First Hospital of Jilin University, Changchun, China.

[*] Correspondence: Min Wang, and Tongjun Liu, Department of General Surgery, the Second Hospital of Jilin University, Changchun 130041, China (e-mail: jdeywangmin@163.com [MW] and tongjunliu@163.com [TL]).

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1. Introduction

Endometriosis is a chronic inflammation with the presence of endometrial glands and stroma outside the uterine cavity, which has a morbidity of 0.1% of females between 15 and 49 years old.[1] Deeply infiltrating endometriosis (DIE) is defined as a solid endometriosis mass located deeper than 5 mm under the peritoneum.[2] Endometriosis infiltrating the rectum is frequently associated with DIE.[3] As one of the most severe forms of DIE, rectal DIE affects approximate 10% of endometriosis female patients.[4,5] Due to dysmenorrhea and/or failure of fertilization, most such patients tend to seek help from obstetricians and gynecologists. However, with the development of laparoscopy, it comes to reality that laparoscopic anterior resection of rectum (AR) as an optional treatment, which is often performed by surgeons of general department, can pursue for a long period of post-surgery dissatisfactory-free, which is characterized as a minimally invasive surgical approach.

Traditionally, medicine treatment is the first option to endometriosis, suggested by clinicians, even still so to date. Because of the risk of post-surgical complications, such as rectovaginal fistula, surgical approaches often come to consideration only after failure of a period of medicine treatment or failure of cycles of in vitro fertilization for endometriosis-associated infertility.[6–9] However, treatment plan should be modified when DIE is diagnosed. In that condition, surgery can be the first and optimal choice for most DIE cases, especially for rectal and sigmoidal DIE cases.

Unfortunately, the indications and the approaches of surgeries for rectal DIE have not been clearly clarified yet. Some surgical approaches, such as rectal segmental, shaving and discoid resection, have been discussed by authors so far.[10,11] However, none of studies have clearly and thoroughly analyzed the advantages and disadvantages of laparoscopic AR, as a minimally invasive surgery towards rectal DIE. Therefore, the aim of this short-term retrospective randomized trial is designed to analyze the surgical and post-surgical data, in order to evaluate the outcomes of laparoscopic AR, as a minimally invasive treatment of rectal DIE, about the aspects of post-surgical quick recovery, post-surgical complications, recurrence and patients satisfaction.

2. Materials and methods

From January 2018 to December 2019, a prospective randomized parallel cohort research was designed to evaluate the outcomes of 12 months follow-up of 2 therapeutic alternatives, medicine group and laparoscopic AR group, at the Second Hospital of Jilin University, Changchun, China. The participants came from both the General Department and the Obstetrics and Gynecology Department. When the diagnosis of rectal DIE confirmed, all the participants gave their contents to take part in this research voluntarily. Furthermore, this study was approved by the Ethics Committee of the Second Hospital of Jilin University.

2.1. Patients

All the patients followed the flow chart, presented in Fig. 1. The inclusion criteria were as follows: a. age was between 18 years old to 50 years old; b. history of endometriosis was more than 1 year;

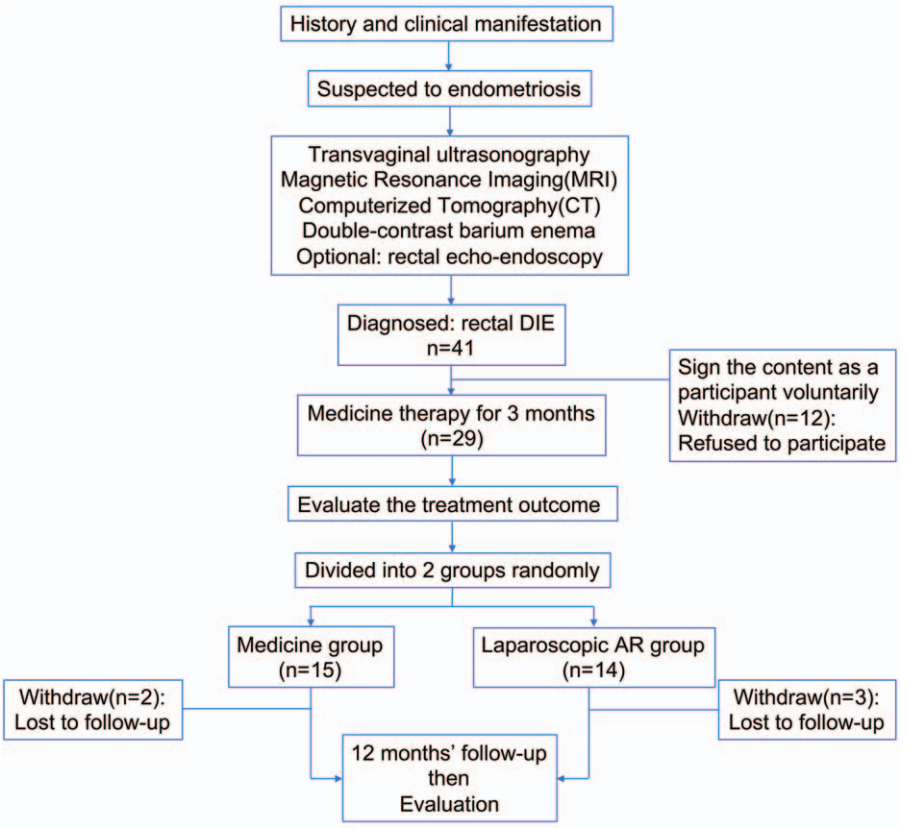

Figure 1. Flow chart showing recruitment during this trial.

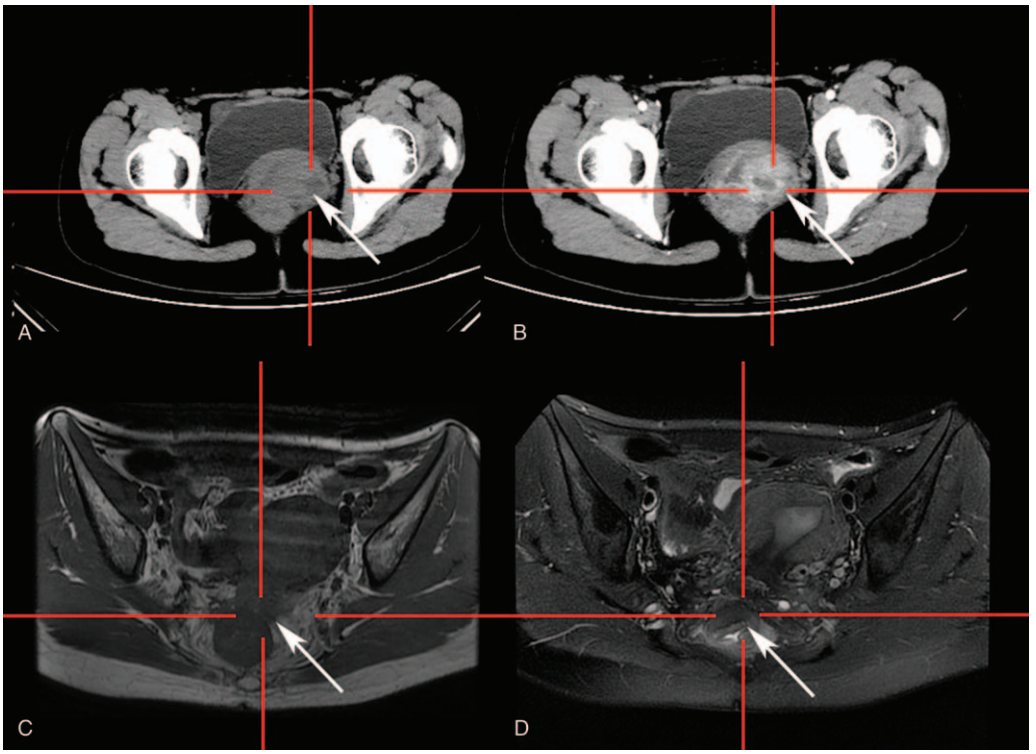

Figure 2. Imaging examinations of CT and MRI showing a DIE lesion around rectum. a. CT image of balance stage. b. CT image of artery stage. c. the manifestation of T1 of MRI. d. the manifestation of T2 of MRI.

c. not plan to have pregnancy within 2 years; d. transvaginal ultrasonography was performed to discover the location lesion of endometriosis; e. magnetic resonance imaging (MRI) and computerized tomography(CT) were performed to define the entire anatomic conditions of the associated rectal tract and pelvic tissues surrounding, to assess the depth of endometriosis, to exclude multifocal lesions and other disease;(Fig. 2) f. double-contrast barium enema was performed to confirm the presence of rectal stenosis, and its degree; g. rectal echo-endoscopy was performed optionally to confirm the depth of endometriosis again, because if the lesion was too distal from anus, such examination cannot reach there. The diagnosis of rectal DIE can be made when the presence of endometriosis at rectum and the invasion depth >5 mm were confirmed simultaneously. Meanwhile, there were also some exclusion criteria. They were the patients who a. suffered a rectal surgery previously for either benign or malignant neoplasm; b. refused to receive a surgical approach; c. had a diagnosis of multifocal endometriosis lesions; d. refused to receive a hormone treatment pre-and post-surgery.

All the participants demographic and clinical characteristics were all listed in Table 1.

2.2. Content reparation

After the diagnosis of rectal DIE made, all patients were noticed to sign a written content to continue this clinical trial. In such content, the side effect in short and long period of progestin as a kind of hormone medicines, the short and long period complications of laparoscopic AR were fully noticed to every participant. Every participant has a fully consideration about DIE relative low curative rate and high recurrence before the study began. A signed content was obtained from every participant

Table 1

All the participants demographic and clinical characteristics.

Case (n = 29)	Medicine group (n = 15)	Laparoscopic AR group (n = 14)	*P* value
Demographic			
Age(years, mean ± SD)	29.33 ± 6.85	28.71 ± 6.82	*P* = .8090
BMI(kg/m^2, mean ± SD)	23.08 ± 2.31	22.05 ± 1.58	*P* = .1755
Clinical characteristics (n, %)			
Infertility	5 (30%)	5 (35.71%)	*P* = .8902
Chronic pelvic pain	13 (86.67%)	12 (85.71%)	*P* = .9525
Dysmenorrhea	11 (73.33%)	12 (85.71%)	*P* = .9422
Constipation during menstruation	6 (40%)	7 (50%)	*P* = .7706

BMI = body mass index.
Statistically significant: $P < .05$.

after carefully consideration, as an essential step for forwarding this trial.

Every participant has strictly followed the protocols which were listed in Fig. 1. What should be pointed out is the hormone medicine therapy strategies were almost the same but only different in dose modification according patients body weight.

2.3. Surgery procedure

Following the patients position and the pneumo-peritoneum reparation, the uterus and bilateral appendages were suspended up through the abdominal wall with a purse string. The sigmoid colon and rectum were clamped with 2 forceps, and pulled them to the left quadrant of the abdomen, in order to expand the mesentery, like a "bullfight cloth". At the root of the rectum and sigmoid colon mesentery around the sacrum Cape level, where was at the middle part of the bifurcation of the left and right iliac arteries, about 2 cm distance from the inner side of the right ureter, cut open the visceral peritoneum. The inferior mesenteric artery (IMA) was isolated from the space between the visceral and parietal peritoneum. The left colon artery was identified and protected carefully. IMA was clipped and cut with the preservation of the left colon artery.(Fig. 3a and 3b) The inferior mesenteric vein (IMV) was isolated at the left side of the IMA root, and clipped with an absorbable clamp at 3 cm from the lower edge of the pancreas, and cut off. Toldt space around left hemi-colon was expanded down to the sigmoid colon. Carefully protected the left reproductive vessels and ureters. With the consideration of the lesion area of endometriosis, the rectum was isolated. Protected the vagina, the anterior sacral visceral nerves and the bilateral ureters during isolating tissues. Remove the endometriosis lesion tissue with a 0.5 cm to 1.0 cm health tissue surrounding.(Fig. 3c and 3d) At 2 cm away from endometriosis lesion towards the rectal distal direction, a colon stapler was used to separate the rectum apart, and to close the proximal and distal rectal lumen simultaneously. Made a 5 cm auxiliary opening incision on the left lower abdominal area. Pulled out part of the descending colon, all of the sigmoid colon and rectum through it. Cut off and removed part of the sigmoid colon and the proximal rectum, including the endometriosis lesion. Place a 28 mm circular stapler base into the end of the sigmoid colon. Reestablished the pneumo-peritoneum, put in the stapler gun body through the anus, connected with the 28 mm circular stapler base. An end-to-end anastomosis was performed approximating the sigmoid colon stump to the rectal stump by this circular stapler. Ileostomy was optional according the situation during the surgery. If the anastomosis line was low, within 5 cm from anal edge, the ileostomy was recommended to perform.

2.4. Post-operation strategy

A medicine strategy for every patient in medicine group was recommended by an obstetrician or a gynecologist. Meanwhile, for those patients in laparoscopic AR group, a same medicine plan was given post-operationally, which was already recommended to patient pre-operationally.

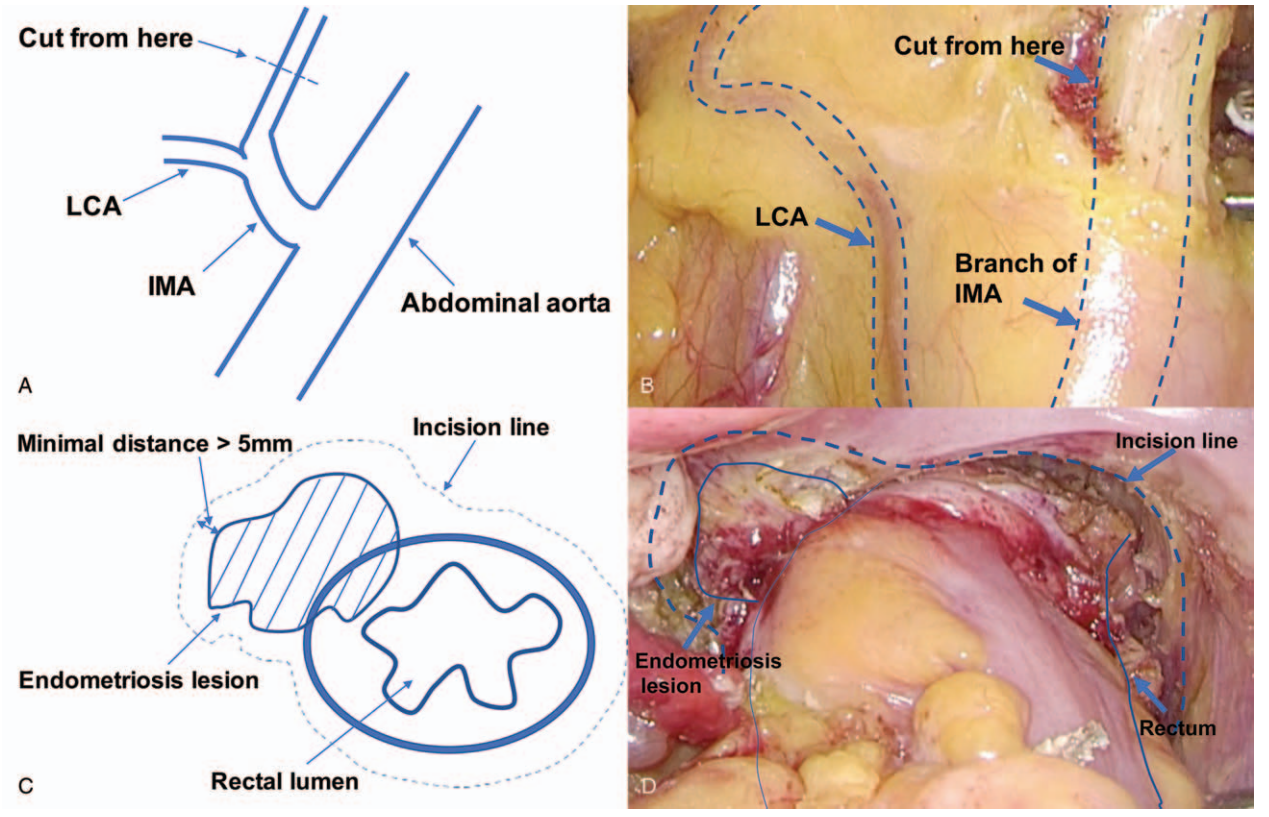

Figure 3. a. a sketch map of important arteries during laparoscopic AR surgery, showing the cut position of an IMA branch; b. a screen shot from a laparoscopic AR surgery video, showing LCA, IMA branch and the cut position; c. a sketch map of relationship among rectum, lesion of endometriosis, and incision line; d. a screen shot from a laparoscopic AR surgery video, showing the position of rectum, lesion of endometriosis, and incision line.

Table 2

Operative data of laparoscopic AR group.

	laparoscopic AR group(n = cases)
Operative time (minutes, n = 14)	76 ± 21
Estimated blood loss (ml, n = 14)	115 ± 41
Conversion to open(cases, n = 14)	None
LOS (days, n = 14)	8 (6–11)
Complications	
Short term(<1month, n = 14)	
Abdominal pain	4 (28.57%)
Abdominal distention	3 (21.43%)
Hemorrhage	None
Bladder injury	None
Anastomotic leak	None
Mortality	None
Long term(1 to 3 months, n = 11)	
Abdominal pain	1 (9.09%)
Abdominal distention	None
Anastomotic leak	None
Incision hernia	None
Mortality	None

LOS = post-operative length of stay.

2.5. Data collection

During hospitalization, the operative time, blood loss, short-term complications, if occurred, and post-operative length of stay (LOS) were recorded.(Table 2) The long-term complications were also tabulated into this table if there happened.

Both during hospitalization and post discharge from the hospital, some special designed questionnaires were chosen to access the changes of symptoms. For this study, 2 of these questionnaires were used to value the intestinal symptomatology, a numeric rating scale (NRS) and a Knowles-Eccersley-Scott Symptom Questionnaire (KESS).[12] One was to value pain intensity of dysmenorrhea, a visual analogue scale(VAS) from 0 (no pain) to 10 (worst pain imaginable). Two were to access constipation during menstruation, a Wexner constipation score (WCS) and an Abdominal Bloating Score (ABS).[13] The time set points we chose to record were the start of the 2 groups selected, 3 months post-surgery, 6 months post-surgery, 9 months post-surgery and 12 months post-surgery.(Table 3)

A numeric rating scale (NRS) was also used widely by some other studies. It was an 11-point numeric rating scale, from 0 indicating the absence of symptom to 10 as severe as the most. In this clinical trial, this questionnaire was for intestinal symptoms, such as pain, bloating, lack of bowel movements.

Beside NRS above, the KESS questionnaire was also filled out by every participant, which was a well-known, validated, multidimensional measurement. In this form, 11 questions were required to answer, with 4 or 5 mutually exclusive options and corresponding 0 to 3 or 4 scores for each one. Item scores are summed up to 39, with higher scores indicating higher symptom severity.

WCS was a questionnaire which accessed the participants stool consistency and their satisfaction during this study, on a scale of 0 to 30 in which a higher score meant more severe constipation, normally the score of a healthy person was less than 8. While ABS was a score scale ranging from 0 to 4, in which 0 meant absence of abdominal bloating, 1 meant occasionally, 2 meant sometimes, 3 meant most of the time and 4 meant all the time.

One figure was designed to evaluate the overall outcomes of these 2 different treatments group, the medicine group and the laparoscopic AR group. It was an efficacy endpoint which has recorded the overall symptom improvement score given by the participants at the time set point of the start of the 2 groups selected, 3 months post-surgery, 6 months post-surgery, 9 months post-surgery and 12 months post-surgery, with the standard following statement: "The treatment helped to improve my endometriosis-related problems", using a 5-point Likert Scale (0:

Table 3

Assessment by questionnaires before surgery and at each post-operative visit.

	Baseline	3 months	6 months	9 months	12 months	*P* value of baseline vs. 12 months
NRS (mean ± SD)						
Medicine group (n = 13)	8.01 ± 2.31	5.41 ± 3.01	5.26 ± 2.65	5.14 ± 1.62	5.99 ± 2.31	*P = .0354
Laparoscopic AR group (n = 11)	8.33 ± 1.59	3.04 ± 1.91	3.16 ± 1.71	3.72 ± 2.38	4.02 ± 2.53	*P = .0001
P value between 2 groups	P = .7020	*P = .0347	*P = .0343	P = .0973	P = .0588	
KESS (mean ± SD)						
Medicine group (n = 13)	13.89 ± 1.21	7.01 ± 1.03	7.74 ± 2.22	8.31 ± 1.62	10.98 ± 2.53	*P = .0010
Laparoscopic AR group (n = 11)	14.52 ± 1.94	5.64 ± 1.54	6.03 ± 1.59	8.92 ± 2.41	7.42 ± 3.17	*P < .0001
P value between two groups	P = .3422	*P = .0164	*P = .0445	P = .4684	*P = .0057	
VAS (mean ± SD)						
Medicine group (n = 13)	7.21 ± 1.25	3.58 ± 2.01	2.29 ± 1.63	2.18 ± 1.42	2.23 ± 1.59	*P < .0001
Laparoscopic AR group (n = 11)	6.31 ± 1.01	0.50 ± 0.38	0.93 ± 0.31	1.01 ± 0.33	1.59 ± 1.37	*P < .0001
P value between 2 groups	P = .0686	*P < .0001	*P = .0126	*P = .0142	P = .3071	
WCS (mean ± SD)						
Medicine group (n = 13)	15.52 ± 1.21	8.92 ± 2.45	7.31 ± 2.83	7.42 ± 1.83	7.90 ± 3.25	*P < .0001
Laparoscopic AR group (n = 11)	16.41 ± 2.09	4.43 ± 1.02	5.29 ± 1.35	4.32 ± 2.46	6.01 ± 2.53	*P < .0001
P value between two groups	P = .2064	*P < .0001	*P = .0417	*P = .0019	P = .1315	
ABS (mean ± SD)						
Medicine group (n = 13)	2.01 ± 1.31	1.42 ± 0.71	1.37 ± 0.82	1.52 ± 0.98	1.39 ± 1.02	P = .1907
Laparoscopic AR group(n = 11)	1.98 ± 1.25	0.61 ± 0.34	0.72 ± 0.52	0.32 ± 0.29	1.31 ± 1.05	P = .1886
P value between two groups	P = .9550	*P = .0023	*P = .0335	*P = .0008	P = .8519	

* Statistically significant: $P < .05$.

ABS = abdominal bloating score, KESS = Knowles-Eccersley-Scott Symptom Questionnaire, NRS = numeric rating scale, VAS = visual analogue scale, WCS = wexner constipation score.

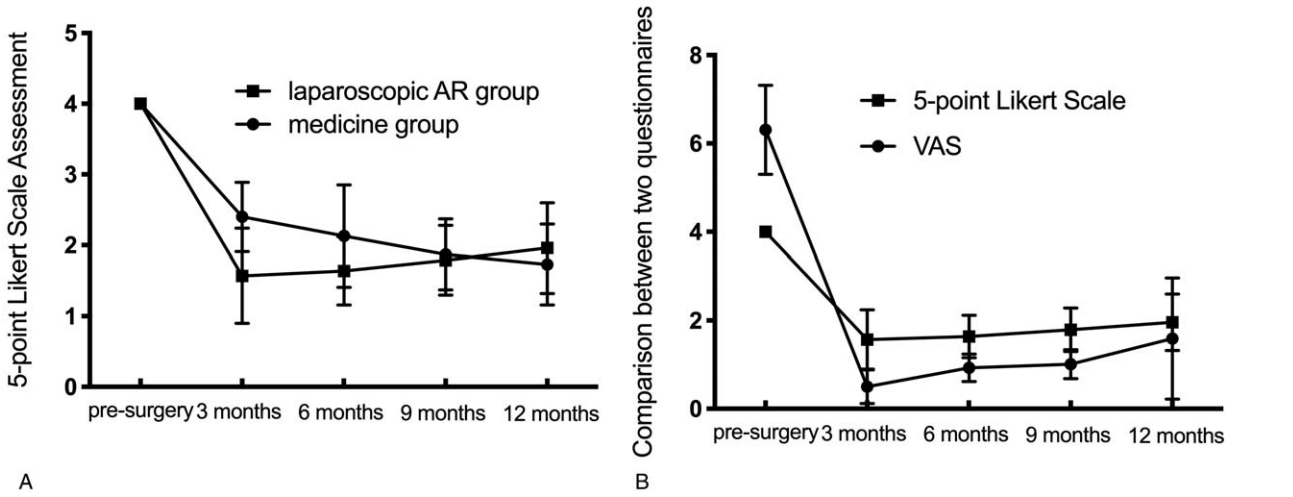

Figure 4. a. 5-point Likert Scale Assessment in both medicine group and laparoscopic AR group; b. a simultaneous showing with a comparison between 5-point Likert Scale and VAS in laparoscopic AR group.

strongly disagree, 1: disagree, 2: neither agree nor disagree, 3: agree, and 4: strongly agree).(Fig. 4)

2.6. Statistics management

Data were archived using Excel 2018 (Microsoft Corporation, USA) and exported in PRISM 8.0 (GraphPad, USA). The data of patients demographic, such as age, BMI, and some of operative data, such as operative time, estimated blood loss, were recorded as mean ± SD (Standard Deviation). These data above were compared using Fishers exact test as appropriate, including Mann–Whitney test and unpaired Student *t*-test. The distributed variables were also recorded as mean ± SD, compared by using unpaired Student *t*-test, paired Student *t*-test or analysis of variance for repeated measures. Statistical analysis of continuous values between medicine group and laparoscopic AR group was through the independent samples *t* test. The Mann–Whitney *U* test and the χ^2 test were used for the comparison of quantitative data. All statistical tests were two-sided, considering $P < .05$ as statistically significant.

3. Results

3.1. The demographic and clinical characteristics of population and algorithm of recruitment during this trial

Twenty nine patients were enrolled in this clinical trial, of which age distribution, BMI and clinical characteristics had no statistic differences, as shown in Table 1. From this table, clinical characteristics data revealed that chronic pelvic pain and dysmenorrhea were the main complaints in both groups.(chronic pelvic pain 86.67% vs 85.71%, dysmenorrhea 73.33% vs 85.71%) They were recruited from January 2018 to September 2018, and received hormone therapy for the first three-month then. Of them, 15 patients were randomly assigned to medicine group, and 14 patients were to laparoscopic AR group, who received a surgery treatment following. All the patients attended clinical visits at the time of randomization into 2 different therapy groups (baseline) and at 3-month intervals for 1 year, with the last follow-up in December 2019. Excluding the ones withdrawn, 24 patients finally completed this study.(Fig. 1)

3.2. Surgical data and complications

Analysis of primary outcomes after surgery treatment revealed the patients in the laparoscopic AR group presenting a similar recovery period comparing a carcinoma-associated laparoscopic AR surgery in our department, without serious complications in short and long term period.(Table 2) 14 patients operative data were acquired during admission period and short term period, while as 3 patients lost to follow-up, 11 patients operative data were assessed in long term period of post-surgery. As shown in Table 2, the operative time was 76 ± 21 minutes, estimated blood loss was 115 ± 41 ml, which were suggesting this approach was a minimal invasion towards patients. Furthermore, LOS was only 8 days, which presented the patients in a rapid recovery state without serious short term complications. No cases in 14 patients were conversion to open surgery from laparoscopy.

For short term complications, abdominal pain was observed 4 in 14 patients (28.57%), while abdominal distention was presented 3 in 14(21.43%). All the abdominal pain were analgesic medicine free. And all the abdominal distention were relieved gradually. No hemorrhage, bladder injury or anastomotic leak were observed within 1 month post-surgery. As a long term complication, only 1 patient in 11 complaint a chronic mild abdominal pain around incision area, who was suggested to receive a physical treatment following.

3.3. Assessment of values of functional outcomes by some questionnaires

The assessments of values of some functional outcomes by different questionnaires in terms of scores were tabulated in Table 3. The scores were recorded at designed time set point of baseline, 3, 6, 9, and 12 months post-operatively. NRS, assessing intestinal symptomatology, in medicine group presented 8.01 ± 2.31, 5.41 ± 3.01, 5.26 ± 2.65, 5.14 ± 1.62 and 5.99 ± 2.31 at that 5 time points, while NRS in laparoscopic AR group were 8.33 ±

1.59, 3.04 ± 1.91, 3.16 ± 1.71, 3.72 ± 2.38 and 4.02 ± 2.53. These 2 series scores had significant statistical difference at 3 months and 6 months post operatively. KESS, another approach valuing intestinal symptomatology, showed 7.01 ± 1.03 in medicine group vs 5.64 ± 1.54 in laparoscopic AR group at 3 months, and 7.74 ± 2.22 in medicine group vs 6.03 ± 1.59 in laparoscopic AR group at 6 months, which had same statistical outcome compared with NRS. A form of VAS was implied to have a primary assessment of pain severity, as a main clinical manifestation of endometriosis. The scores of VAS were 7.21 ± 1.25 at baseline in medicine group vs 6.31 ± 1.01 in laparoscopic AR group without statistical significance. However, the scores at 3 months and 6 months post operatively between the 2 groups were statistically significant (3.58 ± 2.01 vs 0.50 ± 0.38 and 2.29 ± 1.63 vs 0.93 ± 0.31). Interestingly, this trend in VAS was corresponding with the trend in NRS and KESS. Furthermore, the 2 questionnaires of WCS and ABS were used to assess the symptom of bowel movements and abdominal bloating. The patients of laparoscopic AR group tended to have better constipation-free style and asymptomatic abdomen at 3 months, 6 months and 9 months post operatively compared with those of medicine group (8.92 ± 2.45 vs 4.43 ± 1.02 in WCS, 7.31 ± 2.83 vs 5.29 ± 1.35 in WCS, 7.42 ± 1.83 vs 4.32 ± 2.46 in WCS, 1.42 ± 0.71 vs 0.61 ± 0.34 in ABS, 1.37 ± 0.82 vs 0.72 ± 0.52 in ABS, and 1.52 ± 0.98 vs 0.32 ± 0.29 in ABS). The abdominal symptom recovery trend was almost as same as the pain severity recovery trend in both groups.

The improvements of overall DIE symptom assessment post-operationally are shown in Table 4, by using a 5-point Likert Scale. In this table, the overall symptom of laparoscopic AR group were improved by time, and significantly got better at the third month after the surgery. The detail scores of laparoscopic AR group were 1.57 ± 0.67 at the 3rd month post-operation, 1.64 ± 0.48 at the 6th month post-operation, 1.79 ± 0.49 at the 9th month post-operation, 1.96 ± 0.64 at the 12th month post-operation. Meanwhile, in this study, the improvements of overall DIE symptom of medicine group at the same follow-up time point were compared with that of laparoscopic AR group. The data of medicine group were 2.40 ± 0.49 at the 3rd month post-operation, 2.13 ± 0.72 at the 6th month post-operation, 1.87 ± 0.50 at the 9th month post-operation, 1.73 ± 0.57 at the 12th month post-operation. The trend of recovery in both 2 groups were almost same, however, the operation group tended to have a significant improvement at the 3rd month. Furthermore, the comparison of a 5-point Likert Scale between the 2 groups were also shown in Fig. 4a. Meanwhile, with the purpose of analysis of change of patients satisfaction, VAS, as an assessment of the main clinical manifestation of endometriosis was also shown simultaneously with scores of 5-point Likert Scale of operative group. (Fig. 4b) All the patients were satisfied with the outcome of the 2 kinds of treatments comparing with the symptoms pre-treatment, of which patients in laparoscopic AR group had a higher level of satisfaction at 3rd month and 6th month post-baseline.

Table 4

5-point Likert Scale assessment at time set point pre- and post-surgery.

	Medicine group (n = 13)	Laparoscopic AR group (n = 11)	*P* value
Baseline	4	4	
3 months post-surgery	2.40 ± 0.49	1.57 ± 0.67	*$P = .002$
6 months post-surgery	2.13 ± 0.72	1.64 ± 0.48	$P = .0677$
9 months post-surgery	1.87 ± 0.50	1.79 ± 0.49	$P = .6973$
12 months post-surgery	1.73 ± 0.57	1.96 ± 0.64	$P = .6940$

* Statistically significant: $P < .05$.

Baseline was set at time set point pre-surgery.

4. Discussion

DIE, as a serious subtype of endometriosis, has been a difficult disease which often confuses physicians and surgeons due to its relative low curative rate and high recurrence. Since the failure of medicine treatment, surgical involvement of rectal DIE has become a topic of increasing interest among doctors of gynecological department and general department. However, the choice of surgical techniques and the indications of surgery have been widely discussed.[10,14–19] This current clinical trial, by comparing with the outcomes of medicine group, confirms the feasibility of laparoscopic AR surgery as a minimal invasion for rectal DIE if following strict eligible inclusive and exclusive criteria.

So far, medicine treatment including hormone therapy has still been an optimal alternative for the endometriosis.[20,21] The purposes of medical therapy are to control even relieve the chronic abdominal pain, to improve the quality of life.[22] Following a basic mechanistic understanding of estrogen as the most potent stimulus of survival and inflammation in ectopic endometrial tissues, treatments for endometriosis-associated pain usually focus on suppression of ovulation and estrogen production, such as oral contraceptives, progestins, or GnRH agonists.[22–24] However, the incidence of side effects for the patients who have chosen oral contraceptive or a progestin is often high. Additionally, the symptom of endometriosis recurs when medicine treatment ceases. Some of them have to turned to choose a surgical treatment for drug intolerance.

Due to variations of the lesion locations and the infiltration depth, the classification of surgical techniques is far more complicated, and still comes to no common sense. Martin and Batt held the point view that the classification of surgical approaches differs according to whether an isolation of the lesion or not, and to whether the existence of infiltration towards the posterior vaginal fornix or not, which is closed to Adamyans classification system.[25] Partial cystectomy, resection of utero-sacral ligament, partial vaginal resection, intestinal resection by laparoscopy or by laparotomy are reported in literatures.[9,11,26–28] Furthermore, if the surgery is related to intestine, subtypes of operative techniques can include appendicectomy, small bowel resection, ileocecal resection, sigmoid resection, full-thickness rectal disk excision with or without colorectal anastomosis or coloanal anastomosis.

In our study, 1 group of participants received laparoscopic AR surgery, which should be classified to intestinal resection. Considering that the rectal DIE frequently infiltrated the upper third of the posterior vaginal wall, but not rather the lower rectovaginal septum, surgical strategy experience for rectovaginal septum is relative insufficient.[29] It is still widely debated which is the more suitable surgical therapy of rectal DIE between nodule excision by shaving or by full-thickness disc excision and rectal resection, especially for the lesion infiltrating to lower rectovaginal septum.[10] An overall complication incidence, reported by Abo et al, was high up to 45% post disc excision, with a rectovaginal fistula rate of 3.7%.[9] However, a clinical trial of rectal resection reported by Roman H. et al showed there was a

Table 5

Scores for Surgical Indications.

	score
Depth of lesion	
<2 mm	0
2–5 mm	1
>5 mm	2
Involving degree of the circumstance	
<45°	0
45–90°	1
>90°	2
Length of lesion	
<1 mm	0
1–3 mm	1
>3 mm	2

Significance for scores: 0–2 recommended for medical treatment; 3–4 recommended for surgery; 5–6 strongly recommended for surgery.

significant higher rate of anastomotic stenosis.[11] Our opinion is laparoscopic AR would be a more reliable option for the rectal DIE since it has advantages of feasibility, flexibility and mini-invasion during surgical process, elevating the possibility of thoroughly total lesion resection, without obvious serious peri-operative complications.(Table 2)

To date, there has been a common sense for the indication of colorectal resection, which is that a patient who still suffers from endometriosis-associated symptom (s) after standard medicine therapy and/or who is with an endometriosis-associated infertility after failure of 2 cycles in vitro fertilization.[30] This is also the theoretic basis of this clinical trial flow chart designing, of which surgical involvement started after 3 months period of medicine therapy. Depending on our clinical experience, the former-mentioned indications lacks some details for rectal DIE. We have tabulated a table with some aspects as detail indications for the patients who are wondering whether receiving a medicine therapy or a surgical involvement.(Table 5) It is the first time, as far as we know, to assess the surgical indications of rectal DIE in term of score value system. In this table, 3 imaging examination manifestations are listed, depth of lesion, involving degree of the circumstance and length of lesion, which were also observed as crucial issues in other reports.[31–35] The highest score of every aspect is given to the most severe changing caused by endometriosis, with a ranging score from 0 to 2. The total score presents the severity of lesion degree. It is divided into 3 grades, score of 0 to 2 recommended for medical treatment, score of 3 to 4 recommended for surgery, and score of 5 to 6 strongly recommended for surgery. This table we think is an efficient supplement for rectal DIE indications. However, the scores are only a suggestion which recommends for a surgery, definitely, the clinicians should make a final decision according their own clinical experience. This table is a first-edition, with additions in future.

As shown in Table 3, some widely used questionnaires were implied to make a comparative assessment between the medicine group and laparoscopic AR group at baseline and post-operative time set points. The intestinal symptomatology in the laparoscopic AR group was most obviously improved at 3 months post-surgery. The advantage of intestinal symptomatology improving in the surgical group was also observed significantly at 3 month. However, by the follow-up moving on, the difference between these 2 groups become increasingly ambiguous. The same situation was found in other questionnaires else. Especially, at time point of 12 months, the values of NRS, VAS, WCS, and ABS had no statistically significant.

As an overall value, the 5-point Likert scale assessment was used in both groups.(Fig. 4) The outcomes of treatment were shown in Figure. 4a with comparison. The trend corresponded with the results of scores in Table 3. These results of Table 3 and Figure. 4a gathering together came to a conclusion that laparoscopic AR group can relieve the symptoms rapidly, however, this advantage over the medicine group would tend to almost vanish by time passed. In order to explain this finding, we compared the results among the questionnaires, VAS, presenting one of main complaints, has almost coincided responding with the overall outcome changing of the surgery group. Considering the huge decrease of VAS at the beginning of the first 3-months period (shown in Table 3), patients would tend to have a hypotheses that DIE could be removed and cured thoroughly. However, with the re-occurrence of symptoms, a higher complaint scores may be given. Due to this phenomenon, a supplemental medicine treatment plan, containing analgesics combined with or not suppression-medicine of ovulation and estrogen production, such as oral contraceptives, progestins, or GnRH agonists, would be recommended to post-surgery patients for pursuing a longer term relief of endometriosis and a better post-operative overall outcome. Paolo Vercellini et al who have designed a comparative clinical study with a medical treatment group and a surgical treatment group of disc excision held the view that a comprehensive therapy including medicine and surgery could receive a better outcome.[36]

Some limitations of this present clinical trial still deserve to be underlined: a. a relative 12 months follow-up period is not long enough to have a sufficient assessment of the recurrence rate; b. owing to the quantity of participants, a more reliable outcome may require a larger grouped random comparative study in future; c. the score valuation system of surgical indications is the first-edition according to our experience, more details and more weight assignments by using statistical methods are strongly required to improve this system; d. this study was not designed to observe recurrence rate or fertility in a long term(>12 months).

5. Conclusion

We have a prospective randomized parallel cohort research to compare the outcomes of laparoscopic AR with medicine group for rectal DIE. Despite some limitations, this current study confirms advantages of laparoscopic AR in rapid symptoms relief, quick recovery from minimal invasion. However, further studies and data collections are required to evaluate the surgical indications and the outcome of surgery combined medicine in a long time follow-up.

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Author contributions

Conceptualization: Yongping Yang, Ling-Yun Yu, Min Wang, Tong-Jun Liu.

Data curation: Yongping Yang, Jian Shi, Min Wang.

Formal analysis: Yongping Yang, Jian Shi, Jian-nan Li, Min Wang.

Investigation: Yongping Yang, Ling-Yun Yu, Jian Shi, Jian-nan Li.
Methodology: Yongping Yang, Ling-Yun Yu, Jian Shi, Tong-Jun Liu.
Supervision: Yongping Yang, Tong-Jun Liu.
Validation: Min Wang.
Visualization: Yongping Yang, Min Wang, Tong-Jun Liu.
Writing – original draft: Yongping Yang, Ling-Yun Yu.
Writing – review & editing: Yongping Yang, Ling-Yun Yu, Min Wang, Tong-Jun Liu.

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