ORIGINAL ARTICLE

The Assessment of Perioperative Outcome and Cost-effectiveness of Laparoscopy versus Open Surgery in the Management of Periappendiceal Abscess: A Comparative Multicentric Study

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Abstract

Aim: To investigate the perioperative outcomes and cost-effectiveness of the laparoscopic approach for patients with periappendiceal abscess (PA) in comparison with the open approach. The controversy is still evolving as regards laparoscopic surgery in cases with complicated appendicitis in general.

Materials and methods: Three-center analysis of the records' data of candidates >14 years of age with PA operated from January 2017 until October 2020 by either laparoscopic or open approach. Demographic and clinical data, perioperative outcomes, and cost-effectiveness were recorded and analyzed.

Results: Within the study period, 399 eligible cases with PA were identified by clinical evaluation conjoined with the US and/or CT, of which 143 patients underwent laparoscopic appendectomy (LA) and 256 patients had an open appendectomy (OA). The average operating time was 78 minutes for the LA group and 62 minutes for the OA group ($p < 0.001$). The mean hospital stay was 6.3 days for LA and 7.4 days for the OA group ($p < 0.001$). There were 18 cases in the LA group who had surgical site infections, and there were 27 ones in the OA group ($p = 0.001$). There were six patients who suffered from a recurrent intra-abdominal collection in the LA group and four cases in the other group ($p = 0.37$). Laparoscopic appendectomy had a lower odds for the development of any specific surgical complication in the multivariate analysis (OR, 0.381, $p = 0.008$). The total expenses of management were marginally higher by about $300 in the LA group.

Conclusions: Laparoscopic appendectomy is an efficient and safe operative approach in the management of PA, and it exhibits clinically beneficial merits over OA against marginally longer operating time and higher management expenses.

Clinical significance: Laparoscopic surgery for appendicitis complicated with an abscess is feasible and safe. It offers beneficial merits over the open approach.

Keywords: Appendicitis, Appendectomy, Laparoscopy, Open surgery, Periappendiceal abscess.

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Introduction

The surgery of open appendectomy (OA) has become the gold standard for the management of acute appendicitis (AP). However, the operation of appendectomy itself has remained unchanged for more than a century, and the treatment of periappendiceal abscess (PA) is controversial.[1–3] Open surgery for PA is technically difficult and may be associated with surgical complications (SCs). Moreover, persistent complaints, recurrent intra-abdominal abscesses, and multiple healthcare visits can complicate drainage techniques followed by interval appendectomy (IA).[4,5]

Till now, there is no standard universal treatment policy among various physicians. The literature comparing urgent operative intervention and nonoperative management has increased nowadays investigating the nonoperative issue or the IA. Although the nonoperative strategy was advised by many reviews and meta-analysis, because it was accompanied by a lower rate of complication and morbidity,[6,7] one prospective research[6] concluded that urgent surgical treatment was superior

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to the nonoperative approach. Other publications did not show any clinically important differences between the two strategies.[8]

The postoperative complications are a significant issue for urgently operated cases, with surgical site events being in up to 17% of cases; additionally, operative intervention may result in ileocecal resection or right hemicolectomy.[9] Laparoscopic appendectomy has acquired the favorability of many hospitals worldwide. It was recommended by various researchers and meta-analysis,[10–12] to be an amenable and efficient approach, with many clinical merits, like the reduced incidence of surgical site infection (SSI), less postoperative ileus, less postoperative pain, reduced length of hospital stay, and early return to daily activities. As LA was accompanied by a lowered risk of postoperative complications, it may represent a considerable alternative for urgent treatment of PA than IA and an urgent open approach. But there are still limited studies that compare LA with OA and the development of SCs. The objective of this comparative activity was to perform a comparison of the perioperative outcomes (length of hospital stay, operative time, SCs, start to oral feeding, and return to daily work) and cost-effectiveness in LA vs OA in these cases with PA.

Materials and Methods

Study Design and Patient Population

A three-center observational study had been conducted, after securing ethical approval from our local institutional research board, for the analysis of the records' data of candidates diagnosed with PA and they had been operated on within the period from January 2017 until October 2020 either by laparoscopic or open approach. Out of 4,133 patients with AP who underwent operations in our institutions, 399 eligible cases with PA were identified by clinical evaluation conjoined with the US and/or CT. These patients were divided into the LA group (143 patients) if they had LA, and the OA group (256 patients) if they had an OA, solely based on the surgeon's approach and patient criteria. The study was ethically conducted in accordance with the Declaration of Helsinki.

Inclusion Criteria

All patients >14 years of age with a postoperative diagnosis of a well-defined PA, which was identified by clinical evaluation conjoined with the US and/or CT, were recruited. PA was defined if the localized abscess was present exclusively in the right lower quadrant or extended to the pelvic region. All cases with percutaneous interventional drainage, generalized peritonitis. History of major open abdominal surgery, pregnancy, and severe medical comorbidities that preclude pneumoperitoneum were excluded from the research.

Surgical Technique

All patients of both groups received preoperative intravenous third-generation cephalosporins and metronidazole. A Foley catheter and nasogastric tubes were inserted as needed.

All surgeries were performed by an attending senior member (Staff or Fellow) of the general surgery department of our three centers. The operative technique was decided according to the operator's preference. LA was performed using open or closed methods for pneumoperitoneum and the approach of three ports was performed. According to the surgeon's preference, an additional 5-mm port might be needed. Cautious dissection of periappendiceal adhesions was done. Suction drainage of PA was completed after taking swabs. Control of the mesoappendix was secured with vessel sealing devices or clips before cutting it. Amputation of the appendix was done after intracorporeal or extracorporeal ligature of the base and extraction using endobag was done. Copious irrigation with warm saline solution and lavage was done based on the operator's preference. A suction drain was left as needed. Open appendectomy was performed by making an Mc Burney's incision with or without extension. Postoperative assessment of pain was achieved using the visual analog scale (VAS) on the first postoperative day (POD1) and analgesia was given accordingly. Analgesics in the form of NSAIDs were administered as required by patients. Intravenous fluids were administered to all patients until the return of bowel function when oral intake of clear fluids was started.

Consent for publication: Available
Availability of data and materials: Available

The Variables of Patients' Follow-up Evaluation

Data of all patients were recorded including demographic data, clinical manifestations, intraoperative events, postoperative monitoring pieces of information, and postoperative complications (early or late).

Any deviation of the expected known postoperative course was defined as a primary SC. Surgical site infection, recurrent abscess formation, and ileus were recorded as being specific SC. Readmission and 30-day mortality were the secondary ones. Also, readmissions and reoperations were recorded. Incisional hernia and attacks of mechanical bowel obstruction were followed up as a long-term specific SC.

Statistical Analysis

The data were collected, revised, tabulated, coded, and fed into a PC using the SPSS 26 (IBM Corp., Armonk, N.Y., USA) software. Data were presented and suitable analyses were carried out based on the data type gained for each parameter. Frequencies and percentages were used for representations of categorical data and their comparison was accomplished using the Chi-square test. The mean and standard deviation were used to represent parametric and nonparametric continuous data which were evaluated by the student's *t*-test, and Mann–Whitney *U* test respectively was done for using the variables mentioned before and was analyzed using Logistic regression to identify the presence of SC and their risk factors. An intention-to-treat basis was the cornerstone of this comparative analysis between the two groups. Thus, the cases in the laparoscopic-assisted group that were converted to OA were not excluded, but they were transferred to cases of an open one. If the p-value was ≤ 0.05, it was considered statistically significant.

Results

Demographic Data and Clinical Characteristics

The demographic and clinical features of the recruited patients according to LA or OA approach are presented in Table 1. Among the 399 cases eligible for this study, 149 patients (37.4%) had LA. About 6 cases were converted from LA to the OA approach and were added to the OA group. In this observational study, the demographic and clinical features of the study sample were very similar with no significant differences between the two groups in the gender distribution, body mass index, comorbidities, and ASA assessment.

Table 1: The demographic and preoperative clinical data of the eligible cases

The demographic features	*LA group (143) N (%)*	*OA group (256) N (%)*	*p-values*
Age, y (mean ± SD)	36.3 ± 3.7	38.12 ± 2.6	0.341
Male: female	80:63	154:102	0.382
Body mass index	23.9 ± 3.4	25.8 ± 3.5	0.546
Co-morbidities	33 (23.0%)	45 (17.6%)	
CAD	5 (3.5%)	6 (2.3%)	
Hypertension	15 (10.4%)	18 (7%)	
COPD	8 (5.6%)	9 (3.5%)	
DM	5 (3.5%)	12 (4.7%)	
ASA I, *N* (%)	101 (70.6%)	190 (74.2%)	
II	42 (29.4%)	51 (19.9%)	
III	0	15 (5.8%)	
IV, V	00	00	
The preoperative clinical data			
Abdominal pain	136 (95)	238 (92.9)	0.471
Vomiting	76 (53.1)	135 (52.7)	0.303
Fever	91 (63.6)	157 (61.3)	0.339
Duration of presentation in days (mean ± SD)	4.3 ± 2.6	5.9 ± 3.6	0.238
Heart rate (beat /min)	91.5 ± 22.8	88.6 ± 19.4	0.64
WBC, $\times 10^9$/L	16.7 ± 3.2	17.2 ± 3.6	0.144
Size of abscess (cm)	4.1 ± 1.6	4.7 ± 2.8	0.31

Table 2: The perioperative data and events of both groups

The intraoperative variables	*LA group (n = 143), N (%)*	*OA group (n = 256), N (%)*	*p-values*	*RR (95% CI)*
Operative time, min (mean ± SD)	78.9 ± 28.4	62.1 ± 23.6	0.016	1.79 (0.55–1.42)
Blood loss, mL (mean ± SD)	19.6 ± 5.2	24.9 ± 7.8	0.351	1.82 (0.69–1.78)
Use of drains, *N* (%)	127 (88.8)	241 (94.1)	0.220	1.75 (0.41–1.38)
Failed appendectomy, *N* (%)	7(4.9)	8(3.1)	0.340	1.62 (0.43–1.12)
The postoperative variables and outcome				
Bowel movements (POD1)	133 (93)	214 (83.6)	0.021	1.52 (0.44–0.69)
Start of diet (POD1) *N*	128 (89.5)	156 (60.9)	0.031	1.57 (0.54–0.79)
Postoperative pain (M ± SD)	3.12 ± 0.41	3.84 ± 0.61	0.145	1.51(0.34–0.59)
Parenteral analgesics (doses/day)	1.9 ± 0.5	2.8 ± 0.6	0.024	1.42 (0.49–0.67)
Oral analgesics (doses/day)	1.86 ± 1.14	2.40 ± 2.26	0.035	1.43 (0.34–0.89)
Postoperative LOS/days	6.4 ± 2.3	7.3 ± 2.6	0.032	1.53 (0.41–0.76)
Return to normal activity/day	13.5 ± 3.1	17.1 ± 3.3	0.015	1.57 (0.48–0.87)

Preoperative Assessment and Clinical Data of PA

As depicted in Table 1, the categorical and numerical variables were comparable and nearly similar between the cases of both groups, including duration of symptoms, clinical manifestations like abdominal pain, fever, and vomiting, and laboratory tests like WBC.

Intraoperative Data and Complications

The magnitude difference in the operative theater between both groups was assessed by the operating time measurement, intraoperative estimation of blood loss, and the need for blood transfusion within the perioperative period. These variables showed no statistical difference between the two groups. The intraoperative data are given in Table 2, where the average operating time was higher in the cases of the LA group ($p = 0.016$). The variable of blood loss in failed appendectomy trials and the use of the drains was similar in both groups. Conversion to open surgery was decided in six cases due to dense adhesions mostly and they have been added already to the OA group.

Postoperative Variables and Outcome

The patients (143) with LA were comparable with those (256) with OA in Table 2 as many variables were comparable and statistically significant. Postoperative assessment of gastrointestinal function was done by the first bowel movement (the passage of the first flatus or the first audible intestinal sounds) and the start of oral intake within the POD1. In the matched groups, the first bowel

Table 3: The distribution of short- and long-term postoperative complications between the two groups

	LA group (n = 143), N (%)	*OA group (n = 256), N (%)*	*p-values*	*RR (95% CI)*
Short-term primary complications				
Surgical Complications	38 (26.6)	62(24.2)	0.017	1.61 (0.34–1.10)
Surgical site infection	18 (12.6)	27 (10.5)	0.008	1.88 (0.18–0.81)
Peritonitis or recurrent abscess	6 (4.2)	4 (1.6)	0.370	1.59 (0.44–1.10)
Ileus	12 (8.4)	21 (8.2)	0.029	1.48 (0.24–0.97)
Hemoperitoneum	1 (0.7)	1 (0.4)	0.339	1.52 (0.39–1.10)
Incision dehiscence	1 (0.7)	9 (3.5)	<0.001	1.66 (0.01–0.45)
Short-term secondary complications				
30-day mortality	00	00	00	00
Readmissions	7 (4.9)	9 (3.5)	0.390	1.47 (0.39–1.10)
Long-term complications				
Incisional hernia	2 (1.4)	12 (4.7)	0.046	1.45 (0.44–1.10)
Mechanical bowel obstruction	1 (0.7)	4 (1.6)	0.280	1.44 (0.54–1.10)

movements reported within the POD1 were in 133 (93%) cases of the OA group and 214 (83.6%) cases after surgery in the OA group ($p = 0.021$; OR, 1.52; 95% CI, 0.44–0.69), so the start of oral intake within POD1 was in 128 (89.5%) patients in the LA group vs 156 (60.9%) ($p = 0.031$; OR, 1.57; 95% CI, 0.54–0.79). Assessment of pain postoperatively was achieved using the VAS in POD1 and analgesia was given accordingly. Significant differences were found in the postoperative administration of analgesia for both groups ($p = 0.024$), as less postoperative pain was experienced by patients of LA. The average postoperative hospital stay was 6.4 ± 2.3 days in the cases of the LA group, which was significantly < that of patients of the OA group (7.3 ± 2.6 days) ($p = .032$; OR, 1.53; 95% CI, 0.41–0.76). Earlier return to work was noticed in LA with a significant difference ($p = 0.015$).

Distribution of Postoperative Complications between the Two Groups

As given in Table 3, specific salient SCs were summarized. Mild and recoverable early gastrointestinal manifestations were noticed postoperatively. Surgical complications reported in cases undergoing the LA approach were fewer than in cases undergoing the OA approach ($p = 0.017$; OR, 1.61; 95% CI, 0.34–1.10). The diminished rate of SSI ($p = 0.008$; OR, 1.38; 95% CI, 0.18–0.81) and dehiscence of the incision ($p < 0.001$; OR, 1.08; 95% CI, 0.01–0.45) was reported in cases receiving LA compared with cases receiving OA. About 12 of 143 cases (8.4%) with LA had experienced ileus, which was obviously < the 21 of 256 cases (8.2%) of the OA group ($p = 0.029$; OR, 1.48; CI, 0.24–0.97). About 7 cases in the LA group had readmissions against 9 cases in the OA group ($p = 0.392$). Reoperations of the cases of the recurrent intra-abdominal collection were conducted by open approach and cases of ileus were treated conservatively. Significant differences were found in the variable of the incisional hernia incidence, and the difference was higher in cases with OA than in cases with LA. Mechanical bowel obstruction was noticed to be lower in cases of the LA group compared with the cases of the OA group, but this comparison was statistically insignificant ($p = 0.283$). No cases of mortality were recorded in the follow-up of the cases of the study.

Table 4: The analysis of hospital cost/case of each group

	LA group	*OA group*	*p-value*
Equipment cost	$300	$30	0.001
Theater cost	$250	$250	–
Ward cost/night	$650	$650	–
Cost of Anesthesia	$290	$230	0.232
The mean cost of the in-patient	$1490	$1160	0.041

Analysis of Hospital Cost of the Case of Each Procedure

Marginally higher hospital costs were observed in LA ($1490) than the costs of OA ($1160) as given in Table 4.

Discussion

Laparoscopic appendectomy has been broadly accepted and performed by various surgeons for uncomplicated AP in several hospitals worldwide. The feasibility and safety of the LA were proved in many articles and meta-by analysis[10–12] offering plenty of clinical merits, such as rapidly recoverable ileus, less postoperative pain, less incidence of SSI, reduced length of stay (LOS), and fast return to normal daily activity. Surgeons have recommended the use of laparoscopy for appendectomy; however, the benefit of its use in complicated appendectomy is still controversial.[13–16]

There has been a lack of adequate evidence supporting the use of laparoscopy for the management of complicated appendicitis.[17] Some studies have shown almost equivalent results of the two approaches with respect to morbidity and mortality;[18] many studies clarified significant benefits of the laparoscopic technique, such as less postoperative pain, shorter LOS,[19–21] the chance of exploration of the peritoneal cavity, ease of suction irrigation under vision, and better cosmetic results.[22]

The current prospective observational study addressed the surgical issue of whether the laparoscopic approach efficiently does the improvement of various types of surgical recovery and diminishes the incidence of specific SCs in cases of PA in comparison with traditional open surgery.

In this study, the population was divided into two groups according to the operative approach. The laparoscopic group (LA) included 143 patients. The open group (OA) included 256 patients. No statistical significance was observed between the patients of the two groups regarding the sex difference, age, BMI, ASA grading, or associated comorbidities.

The clinical characteristics of the study population, including major symptoms, duration of symptoms prior to admission, body temperature at the time of admission, and the number of leukocytes showed no statistical significance between cases of the two groups.

As regards the operative findings, with a *p*-value of more than 0.05 in the operative blood loss, the need for drain application, and failed appendectomy, they were statistically insignificant. During the clinical follow-up period, 12 out of 15 cases of failed appendectomy in the study population were passed with no further experience of recurrent attacks; hence, they did not have an interval appendectomy. About three cases had interval OA following the recent attack after variable periods of 6–12 months.

The role of routine IA is currently debatable. Even in cases with localized PA formation, IA is not mandated after successful conservative treatment. The incidence of recurrent attacks of AP is low and at that time, removal of the appendix can be safely performed.[23,24]

The open group involved lesser operative time than did the laparoscopic group, as the average operating time for the LA group was 78.9 ± 28.4 minutes (range: 65–160 minutes), whereas, for the open group, it was 62.1 ± 23.6 minutes (range: 45–145 minutes) with a *p*-value of less than 0.016 by *t*-test, which was statistically significant. Nearly similar findings were obtained by Quezada et al.[25] with longer operative time for the LA group. This may be attributed to the time taken for the peritoneal irrigation, suction, lavage, and securing of the appendicular stump.[26,27]

The rate of conversion was 6 out of 149 patients of LA and they were transferred to the other group (OA), reaching 4.7%, which was within the range compared with other studies.[25,28] In this research, the mean operative time was in favor of the OA group with a significant difference of 16 minutes, which was observed to be of statistical significance. As in the case of PA, the meticulous dissection and safe appendectomy were practically challenging and time-consuming. The average rate of the switch to open approach was due to dense adhesions, mainly severe inflammatory reaction, and even more challenging difficult dissection.

The key point that directly affects the general status of the case and the economic issue is lowered hospital stay, which stemmed from the earlier start of oral feeding, diminished SCs, and so a faster return to daily activity.[29] The characteristic pros of the laparoscopically managed patients of PA over the traditional open surgery contain the aforementioned merits, which were proved by late meta-analysis, which concluded that cases with LA return quicker to daily activities.[30,31]

Our findings included closely recorded variables, with ongoing monitoring of gastrointestinal motility and close assessment by nurse staff, which could be performed continuously in our hospital settings. So, any postoperative gastrointestinal complaints would be recorded in the eligible cases.

Patients in the laparoscopic group needed less analgesia[32,33] as the *p*-value was 0.024, with the early return of bowel habits and the early start of oral feeding. They also had a shorter hospital stay[34] (6.3 vs 7.4 days) and early return to normal activities (13.5 vs. 17.1 days, $p = 0.015$) compared with the cases in the OA group. Also, we reported that the LOS at the hospital was shorter in cases with the LA group with a statistically significant difference ($p = 0.032$) with a superior conjoined early recovery of gastrointestinal function and intestinal motility, which subsequently led to an earlier start of oral intake and return to home.

Despite the recruited candidates being different, our results are coping with various research that reported a statistical significance of short LOS for the LA group.[35–37] The applicable reasons for these results might result from the minimal surgical trauma of laparoscopy and little manipulation of the ileocecal area by an experienced skillful physician during laparoscopy, and less postoperative pain owing to the limited extension of the surgical wounds.

In the surgical field, despite the aforementioned merits, open surgery is still widely accepted because of the issues of possible longer operating duration, higher expenses, and in some hospital settings, the absence of equipment and expert surgeons for the LA approach. In general, the long operative time is mostly due to insufficient skills of surgeons, such as handling of the instruments, pneumoperitoneum, and careful monitoring of ports under vision during the operative time.[38,39]

Our institutions have a satisfactory experience with the LA approach for the cases of PA. For the last 6 years, laparoscopy was mostly preferred for the management of cases of PA. Our rate of the switch to OA was only 4.7%; this result pointed to the well-gained experience of the laparoscopic approaches in our institutes. Moreover, advanced training in laparoscopic techniques was spread worldwide, leading to a noticeable reduction in the difference in the operative time.

The present research concluded a noticeably reduced incidence of specific surgical events after the laparoscopic approach for cases of PA. We observed a decreasing rate of salient SCs with 24.2% (62/256) and 26.6% (38/143) for open approach and laparoscopic approach, respectively. This finding agrees with the net results of a recent scientific meta-analysis,[27] which points to AP in the adult population. SSI is frequent in complicated AP; however, it is not a serious event but has a considerable effect on the early postoperative period of recovery and the quality of life.

The significant reduction of SSI rate becomes a major advantage of laparoscopy techniques.[2] In the LA group, 18 (12.6%) patients had SSI, whereas in the open group, 27 (10.5%) patients had SSI; similar results have been reported in other series.[27]

In the laparoscopic group, 2 (1.4%) patients had an incisional hernia, whereas in the open group, 12 (4.7%) patients had an incisional hernia. This emphasizes the advantage of the laparoscopic approach in preventing SSI[40] and incisional hernia in septic operations as in complicated appendicitis. Despite, the definite reason is hard to touch in the clinical setting of contaminated surgery, the lower rate of SSI in LA may result from the tiny incisions of the laparoscopic approach, and specimen retrieval inside the plastic endopouch lowers the probability of SSI. Since this method clarifies the surgical site issues frequently incurred from the conventional approach, it is highly beneficial that skillful physicians can do the highest percentage of these surgeries via a laparoscopic approach despite the abscess.

The recurrence of a postappendectomy intraperitoneal collection is a terrible life-threatening specific SC. We reported recurrent intra-abdominal collection in 6 (4.2%) cases and 4 (1.6%) cases in the LA group and OA group, respectively ($p = 0.37$). there was a significant risk of recurrent intra-abdominal collection after LA, which was published in a recent meta-analysis.[11] But our results agreed with other publications and the most updated research that proved a reduced incidence of intraperitoneal collections,

with no statistically significant difference between the LA and the OA groups. The recurrence of the postoperative intraperitoneal collection has been attributed to the absence of skillful surgeons, improper manipulation, and techniques like an excessive residual of the fluids of lavage in the peritoneal cavity, which in turn causes considerable contamination. An uncontrollable manipulation of complicated appendicitis, especially the ruptured one; moreover, CO_2 insufflation can facilitate the intraperitoneal spread of bacteria. In the current research, the rate of intra-abdominal collection recurrence of the LA group had no significant difference from that of the OA group. We consider that the skillful laparoscopic surgeon is the key part of this finding, which was supported before by some authors.[38,39] The antibiotics therapy was administered regularly per and postoperative in LA in our cases. Despite the high incidence of recurrent formation of the intra-abdominal collection being a little higher after LA, greater improvements in our technique may eradicate this serious event.

One (0.7) patient in the LA group had intestinal obstruction, whereas in the OA group, 2 (.8) patients had an intestinal obstruction in the early postoperative period due to fibrinous adhesions, and 2 (.8%) patients had adhesive intestinal obstruction after 17 and 19 weeks, respectively. This can be attributed to the fact that the laparoscopic approach was more exploratory than the open approach and it could dissect adhesions made by inflammatory processes compared with the open approach, and to the fact that the absence of the large abdominal wall wounds prevents the intestine from adhering to the wound scar, which occurred with the open approach.[41] LA was associated with lower odds for developing any SC in the multivariate analysis.

The laparoscopic equipment was costly ($300 in our institutions) compared with the traditional open approach ($30 in our hospital settings) and they did not represent an obstacle to their valuable utilization. This higher cost of instruments was little compensated by the shorter LOS, so the total expenses of management were a little higher by $300 in the LA. Also from a social perspective, it was noticed by Moore et al. that LA gained a significant economic concern as a quicker return to normal activities and work is so beneficial, especially for the productive young population in life.[42]

The limitation of this research included its limited centers design, the small sample size, and the choice of the technique as it was a surgeon's decision and patient criteria. The selection of patients for the laparoscopic approach was biased by presentation duration, age of the patients, and surgeon preference. It is still controversial to perform LA with inexperienced hands with respect to the severe inflammatory reaction present.

In brief, the clinical support gained from this research gives the upper hand for LA in the management of cases with PA in terms of early recovery of gastrointestinal functions, SCs, and hospital stay.

We suggest that the utilization of this finding should be generalizable if the institution has laparoscopically skillful surgeons and sufficient laparoscopic resources.

Conclusions

Laparoscopic surgery for appendicitis complicated with an abscess is feasible and safe. It offers clinically beneficial merits over the open approach (including shorter LOS, less postoperative analgesia, early start of oral feeding, faster return to normal daily work, and lower incidence of postoperative complications) against marginally longer operative time and higher hospital costs.

Clinical Significance

Laparoscopic surgery for appendicitis complicated with an abscess is feasible and safe. It offers beneficial merits over the open approach including the perioperative and financial outcome.

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