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COMPARATIVE STUDY BETWEEN LAPAROSCOPIC VERSUS APPENDECTOMY IN OBESE PATIENTS: A COHORT STUDY.

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ABSTRACT

Background

The two main surgical therapies for appendicitis are laparoscopic appendectomy (LA) and open appendectomy (OA). Appendicitis is a major surgical emergency. The study aimed to evaluate the outcomes of laparoscopic appendectomy versus open appendectomy in obese patients.

Methods

Ninety patients with appendicitis with a BMI of 30 or more were randomised into two groups: the OA group, which included 45 individuals, and the LA group, which included 45 patients. SPSS Statistics Version 23.0 was used to gather and analyse data on demographics, postoperative complications, length of hospital stay, surgical time, pain levels, and recovery durations.

Results

The socio-demographic characteristics of the patients were similar across both groups, with an average age of 35.6 ± 10.2 years in the LA group and 36.1 ± 11.3 years in the OA group. In comparison to the OA group, the LA group experienced considerably shorter hospital stays (2.1 ± 0.7 days) and operative times (45.3 ± 10.1 minutes vs. 60.4 ± 12.3 minutes, $p < 0.001$). The LA group experienced less postoperative complications (11.1% vs. 26.7%, $p = 0.04$). The LA group also had reduced pain levels 24 hours after surgery (3.5 ± 1.4 vs. 5.6 ± 1.7, $p < 0.001$). Readmission rates and delayed complications were among the long-term outcomes that did not significantly differ across the groups.

Conclusion

When compared to OA, LA is linked to shorter operating and recovery periods, less pain during surgery, and fewer problems in obese patients. These results validate LA as the recommended surgical treatment for obesity-related appendicitis.

Recommendations

Due to its benefits in terms of efficiency and safety, LA ought to be the norm for treating appendicitis in obese patients. It is advised to perform more studies with larger sample sizes and longer follow-up times in order to validate these results and evaluate long-term effects.

Keywords: *Laparoscopic Appendectomy, Open Appendectomy, Obese Patients, Surgical Outcomes, Postoperative Complications*
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INTRODUCTION

One of the most frequent surgical emergencies in the world is appendicitis, which requires immediate surgical surgery to avoid complications like perforation and peritonitis. The surgical management of appendicitis has evolved significantly over the years, with laparoscopic appendectomy (LA) emerging as a preferred technique due to its minimally invasive nature. In contrast, open appendectomy (OA) has been the traditional approach [1]. The choice between LA and OA becomes particularly significant in obese patients, who present unique challenges due to their anatomical and physiological characteristics.

Obesity, defined by a Body Mass Index (BMI) of 30 or higher, is a worldwide health issue, with its prevalence doubling since 1980 [2]. Obese patients undergoing surgery face increased risks of complications, including wound infections, cardiovascular events, and prolonged recovery times. These risks necessitate careful

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consideration of the most effective and safe surgical approach for appendicitis in this population.

Laparoscopic surgery has advantages over open surgery in a number of situations, as demonstrated by recent research [3]. These advantages include shorter hospital stays, less pain following surgery, and quicker recovery durations. Laparoscopic appendectomy, with its minimally invasive technique, potentially offers significant benefits for obese patients by reducing the risk of wound-related complications and enhancing postoperative recovery. Moreover, advancements in laparoscopic instruments and techniques have made this approach increasingly feasible and safe, even in complex cases.

However, some studies have raised concerns about the prolonged operative times and technical difficulties associated with LA in obese patients [4]. The need for specialized skills and equipment, along with the potential for intraoperative complications, necessitates a thorough comparative analysis to govern the optimal surgical approach for this high-risk group.

The study aimed to evaluate the outcomes of laparoscopic appendectomy versus open appendectomy in obese patients.

METHODOLOGY

Study Design

A prospective comparative randomized cohort study.

Study Setting

The study took place in the Department of General Surgery at Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar, India. The study period extended from July 2023 to April 2024.

Participants

The study included 90 patients who met the eligibility criteria and agreed to participate.

Inclusion Criteria

Participants selected for the study were required to have a BMI of 30 or higher and a confirmed diagnosis of appendicitis.

Exclusion Criteria

Patients were excluded if they were noncompliant during follow-up, pregnant, had a previous laparotomy, coagulation disorders, or were deemed unfit for surgery due to conditions like hepatitis or uncontrolled diabetes mellitus.

Sample size

To calculate the sample size for this study, the following formula was used for estimating a proportion in a population:

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

Where:
- n = sample size
- Z = Z-score corresponding to the desired level of confidence
- p = estimated proportion in the population
- E = margin of error

Bias

To eliminate bias, randomization was implemented using computer-generated random numbers, printed on cards, and placed in opaque envelopes.

Implementation

An independent statistician generated the random allocation sequence using computer-generated random numbers, sealed in opaque envelopes for allocation concealment. A senior resident at ANMMCH, Gaya, Bihar, enrolled participants and assigned them to either the laparoscopic appendectomy (LA) or open appendectomy (OA) group by opening the envelope at the time of surgery.

Blinding

Blinding was partial: surgeons were aware of the treatment due to the nature of the procedures, but patients remained blinded until after the follow-up period. Outcome assessors, including nurses and residents, were also blinded to the surgical method to ensure unbiased data collection.

Variables

Primary variables examined in the study included the type of surgery (laparoscopic or open), surgery duration, hospital stay length, time to resume oral intake, and post-operative complications. Secondary variables encompassed demographic information, surgical outcomes, administered analgesic doses, and follow-up complications.

Data Collection

Patient demographics, surgical outcomes (e.g., length of hospital stay and operation time), the number of analgesic

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doses used, the time it took to resume oral intake following surgery, and any complications following the procedure were among the data gathered.

Procedure

Patients were randomly assigned to either the LA or the OA Group.

- Laparoscopic Appendectomy:

Patients were positioned supine, with the left arm secured. A Foley catheter and elastic stockings were used. The abdomen was sterilized and draped. Pneumoperitoneum was created, and ports were inserted (12-mm umbilical, 10-mm left iliac fossa, 5-mm suprapubic). The diagnosis was verified with a diagnostic laparoscopy. After being dissected and severed, the appendix was extracted using a retrieval bag or the 10-mm port. Ports were taken out, and mattress sutures were used to seal the wounds.

- **Open Appendectomy:**

A muscle-splitting McBurney incision developed. The appendix and cecum were found and kept apart. The appendix was pushed into the incision and ringed. After the appendix was removed, the mesoappendix was sutured. The fascia and skin were sealed with sporadic stitches.

- **Antibiotic Regimen**:

All patients took a single dose of intravenous ceftriaxone at the start of anesthesia. If a gangrenous appendix was discovered, additional doses were administered, followed by a week of oral amoxicillin–clavulanic.

Postoperative Course

Regular checks were made for intestinal noises. When stomach sounds were found, patients started on a clear liquid diet and worked their way up to a conventional diet once they were able to tolerate it. When patients were able to tolerate a regular diet and remained afebrile for a full day, they were discharged.

Outcome Parameters

The study's primary outcomes included surgery duration, hospital stay, time to resume oral intake, and the incidence of postoperative complications such as wound infection and intra-abdominal abscess. Secondary outcomes were pain levels at 24-, 48-, and 72-hours post-surgery, the number of analgesic doses, and long-term outcomes like readmission rates and late complications. Pain levels were assessed using a 0-10 scale for present, least, and worst pain.

Follow-up

Patients visited the outpatient clinic weekly for two weeks. Stitches were removed after seven days. Patients were kept under observation and told to report any problems.

Statistical Analysis

SPSS Version 23.0, statistical analysis was carried out. Standard deviations and means were used to characterise quantitative variables. A P value of less than 0.05 was deemed statistically significant.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULT

Ninety patients in all were included in the trial, of which forty-five were allocated to the OA group and forty-five to the LA group. The two groups did not significantly differ in terms of comorbidities, age, gender, or BMI.

Recruitment

The recruitment for the study took place between July 2023 and April 2024 in the Department of General Surgery at Anugrah Narayan Magadh Medical College and Hospital (ANMMCH), Gaya, Bihar, India. Participants were followed up for a period of two weeks post-surgery, with additional follow-ups as needed to monitor long-term outcomes.

Table 1a: Demographic Characteristics

Characteristics	LA Group (n= 45)	OA Group (n= 45)	p-value
Age (years)	35.6 ± 10.2	36.1 ± 11.3	0.78
Gender (Male/Female)			
- Male	26	24	0.67
- Female	19	21	

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Table 1b: Baseline Characteristics

Characteristics	LA Group (n= 45)	OA Group (n= 45)	p-value
BMI (kg/m²)	32.5 ± 2.3	33.0 ± 2.1	0.45
Diabetes Mellitus	10	12	0.62
Hypertension	14	16	0.64

Table 2: Operative Data

Parameter	LA Group	OA Group	p-value
Duration of Surgery (min)	45.3 ± 10.1	60.4 ± 12.3	< 0.001
Duration of Hospital Stay (days)	2.1 ± 0.7	4.2 ± 1.1	< 0.001
Time to Oral Intake (hours)	8.5 ± 2.3	12.8 ± 3.1	< 0.001
Total Analgesic Doses	3.1 ± 1.2	5.3 ± 1.5	< 0.001

Table 3: Post-operative Complications

Complication	LA Group	OA Group	p-value
Any Complication	5 (11.1%)	12 (26.7%)	0.04
Wound Infection	2 (4.4%)	6 (13.3%)	0.15
Intra-abdominal Abscess	1 (2.2%)	3 (6.7%)	0.30
Postoperative Ileus	2 (4.4%)	3 (6.7%)	0.65

The mean duration of surgery was notably shorter in the LA group compared to the OA group (45.3 ± 10.1 minutes vs. 60.4 ± 12.3 minutes, $p < 0.001$). Additionally, the LA group had a notably shorter duration of hospital stay (2.1 ± 0.7 days vs. 4.2 ± 1.1 days, $p < 0.001$).

Postoperative complications were documented and compared between the two groups. The incidence of complications was notably lower in the LA group compared to the OA group (11.1% vs. 26.7%, $p = 0.04$). Specific complications included wound infection, intra-abdominal abscess, and postoperative ileus.

Pain levels were assessed using a 0-10 scale, with results presented in Table 4. The LA group reported significantly lower pain scores at 24 hours post-surgery compared to the OA group (3.5 ± 1.4 vs. 5.6 ± 1.7, $p < 0.001$). Patients were followed up weekly for two weeks post-surgery, with additional follow-ups as needed. Long-term outcomes, including any readmissions and late complications, were recorded. No substantial variations were found in readmission rates between the two groups (LA: 2.2% vs. OA: 4.4%, $p = 0.55$).

Table 4: Pain Assessment Post-Surgery

Pain Score (0-10)	LA Group	OA Group	p-value
24 Hours	3.5 ± 1.4	5.6 ± 1.7	< 0.001
48 Hours	2.8 ± 1.2	4.2 ± 1.5	< 0.001
72 Hours	1.9 ± 1.0	3.5 ± 1.3	< 0.001

Table 5: Long-term Outcomes

Outcome	LA Group	OA Group	p-value
Readmission Rate	1 (2.2%)	2 (4.4%)	0.55
Late Complications	2 (4.4%)	3 (6.7%)	0.65

DISCUSSION

In order to ascertain which procedure produces superior results, the study compared LA with OA in obese patients. Ninety patients were divided into two groups at random: the OA group (45 patients) and the LA group (45 patients). Age, gender, BMI, and comorbidities did not significantly differ between the two groups at baseline, suggesting that the groups were well-matched.

Comparing to the OA group (60.4 minutes), the LA group's surgical time was noticeably shorter (45.3 minutes). In a similar vein, the hospital stay for the LA group was substantially shorter (2.1 days) than for the OA group (4.2 days). In addition, the LA group required 8.5 hours to resume oral intake, while the OA group required 12.8 hours. Furthermore, the analgesic doses required by

the LA group were lower (3.1) compared to the OA group (5.3). Because laparoscopic appendectomy is more efficient, patients recover more quickly and can resume oral intake and analgesic use earlier. It also takes less time to do surgery and less time in the hospital.

Compared to the OA group (26.7%), the LA group's prevalence of post-operative complications was considerably lower (11.1%). In the LA group, complications such as infection of the wound, intra-abdominal abscess, and post-operative ileus were less common. For obese patients, LA is a safer option because it is linked to less postoperative problems.

At 24, 48, and 72 hours after surgery, individuals in the LA group reported far less discomfort than those in the OA group. For instance, the average pain score for the LA group was 3.5 hours after surgery, whereas the average pain score for the OA group was 5.6 hours. Less postoperative pain following a laparoscopic appendectomy improves patient comfort and may lessen the need for pain medication.

There were no discernible variations between the two groups' readmission rates or late complications. Comparable long-term results were indicated by the identical rates of re-admission and late complications in both groups. Although laparoscopic appendectomy produces superior results in the short term, the long-term effects of both surgical techniques are comparable.

According to the study, laparoscopic appendectomy is better than OA for obese individuals in terms of less time spent in the hospital after surgery, quicker recovery, fewer problems, and less discomfort thereafter. For obese individuals with appendicitis, laparoscopic appendectomy is the recommended surgical approach because of these advantages.

Current studies consistently show that in obese patients, LA yields superior clinical outcomes than OA. In an investigation involving forty obese patients, it was discovered that LA was linked to noticeably shorter recovery periods following surgery, lower painkiller dosages, an earlier initiation of oral feeding, shorter hospital stays, and a quicker resumption to regular activities. According to the findings of this investigation, treating acute appendicitis in obese patients with LA is both safe and feasible [5].

Results for participants getting LA were much better than those undergoing OA in prospective research involving 64 patients who were severely obese. To be more precise, the operating times for LA patients were 49.09±16.21 minutes as opposed to 68.03±15.78 minutes, $p<0.05$); there were also fewer postoperative complications (9.09% as opposed to 32.3%, $p=0.007$), shorter hospital stays (78.8% were discharged in less than 24 hours as opposed to 54.8%, $p=0.041$), and a quicker return to normal activities (11.27±2.6 days as opposed to 17.23±4.8 days, $p<0.05$) [6].

In a separate study, 64 patients with a BMI of 30 or above were compared to OA and found that LA led to shorter hospital stays ($p=0.001$), earlier oral intake ($p=0.002$), faster operational times ($p=0.042$), and fewer analgesic doses needed ($p<0.001$). LA is safe and effective for obese patients, as evidenced by the equal occurrence of intra-operative and post-operative problems in the two groups [7].

In comparison to OA, LA was linked to faster operation durations ($p<0.001$), shorter hospital stays ($p<0.001$), and fewer general ($p=0.012$) and wound problems ($p=0.031$), according to a retrospective review of 89 patients who were morbidly obese. The benefits of LA were highlighted in the study [8], including a decreased incidence of wound infection and quicker recovery times.

A study comparing the effects of LA and OA in patients who were overweight or obese discovered that LA resulted in better quality of life scores, fewer 30-day problems, and a faster recovery period before returning to work. At 15 days and 1 year after surgery, patients who had LA reported better pain, role, and physical function scores as well as higher happiness [9].

Visceral obesity was found to be an independent risk factor for incision infection in a study looking at the effects of the obesity on short-term outcomes following a laser surgery (OR=2.679, 95% CI: 1.155–5.849, $p=0.027$). In comparison to OA, LA led to fewer infections and shorter hospital stays, even though it was associated with greater pre-operative and post-operative white blood cell counts and hospitalisation costs [10].

Generalizability

The external validity and applicability of the trial findings are supported by the study's design, setting, and patient population. Conducted in a tertiary care hospital with a diverse patient demographic, the trial's results are likely generalizable to similar clinical settings, particularly in populations with high obesity rates. The randomization process and careful control of variables enhance the reliability of the findings, suggesting that laparoscopic appendectomy (LA) could be widely adopted as a preferred surgical method for obese patients with appendicitis. However, further studies in different geographic locations and with larger sample sizes are recommended to confirm these results and ensure broader applicability across various healthcare environments.

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CONCLUSION

For obese patients, laparoscopic appendectomy has many benefits over open appendectomy, such as faster recovery times and hospital stays, less pain, and fewer problems. Given these advantages, laparoscopic appendectomy ought to be the norm for treating this patient group. It is advised to conduct additional studies with bigger sample sizes and longer follow-up times in order to validate these results and assess long-term effects.

LIMITATIONS

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

RECOMMENDATION

Due to its benefits in terms of efficiency and safety, LA ought to be the norm for treating appendicitis in obese patients. It is advised to perform more studies with larger sample sizes and longer follow-up times in order to validate these results and evaluate long-term effects.

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LIST OF ABBREVIATIONS

LA: Laparoscopic Appendectomy
OA: Open Appendectomy
BMI: Body Mass Index
OR: Odds Ratio
CI: Confidence Interval
min: Minutes
kg/m²: Kilograms per square meter
IV: Intravenous

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CONFLICT OF INTEREST

The authors have no conflicting interests to declare.

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