RESEARCH

A Comparative Analysis of the Safety and Clinical Benefits of Laparoscopic Versus Open Appendicectomy

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Abstract:

Context: Laparoscopic appendicectomy has been proposed as an alternative to the conventional open technique, but evidence on its comparative safety and benefit remains debated. This prospective randomized study was undertaken to evaluate the relative safety and clinical advantages of the laparoscopic approach against the open approach for the surgical management of appendicitis. **Methods and Material:** A total of 250 patients undergoing appendicectomy, either by the laparoscopic or the open route, were enrolled and followed prospectively. Postoperative complications served as the primary endpoint. Secondary endpoints comprised pain and activity scores recorded at baseline and on each postoperative day, time to resumption of oral diet, duration of hospital stay, and short-term quality-of-life and activity outcomes. **Results:** No deaths occurred in either arm. Overall complication rates were comparable between the laparoscopic and open groups (17.5% and 16%, respectively), although a small number of early complications in the laparoscopic group necessitated reoperation. Mean operating time was significantly longer with the laparoscopic technique (60 minutes versus 40 minutes; P = 0.000), whereas no meaningful differences were observed for pain scores, analgesic requirement, time to resumption of diet, length of stay, or activity scores. At the two-week follow-up, pain and activity scores remained similar between groups. Complication rates for acute as well as complicated (perforated or gangrenous) appendicitis were statistically similar irrespective of the surgical technique employed (P = 0.181). **Conclusions:** In contrast to several other minimally invasive procedures, laparoscopic appendicectomy did not demonstrate a clear advantage over the open technique across most of the parameters assessed, with the exception of quality-of-life scores at two weeks, and it

INTRODUCTION

Laparoscopic appendicectomy (LA) was first described by Semm in 1983, yet more than four decades later it continues to face difficulty in establishing a definitive advantage over the conventional open technique.[1] This stands in contrast to laparoscopic cholecystectomy, a procedure that rapidly gained acceptance as the standard of care for gallstone disease with comparatively little scientific opposition.[2] Open appendicectomy (OA), first introduced by McBurney more than a century ago, remains a well standardized procedure among surgeons; unlike cholecystectomy, it is typically performed through a small right-lower-quadrant incision, and postoperative recovery is generally uncomplicated.[3]

A considerable body of literature, comprising prospective randomized trials, meta-analyses, and systematic reviews, has examined the merits of LA relative to OA.[4-9] However, heterogeneity in the variables measured and methodological limitations across these studies have made it difficult to arrive at firm, generalizable conclusions. Against this background, the present prospective randomized study was designed to compare laparoscopic and open appendicectomy with respect to safety, postoperative recovery, and quality of life.

MATERIAL and METHODS

This study was conducted in the Department of General Surgery, Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh, and included patients presenting with clinically suspected appendicitis.

A diagnosis of appendicitis was established on the basis of the following clinical criteria: a history of right-lower-quadrant or periumbilical pain migrating to the right lower quadrant, associated with nausea and/or vomiting; a documented temperature above 38°C and/or a total leukocyte count exceeding 10,000 cells/mL; and right-lower-quadrant tenderness with guarding on physical examination. Only patients above 15 years of age were included in the study.

Patients were excluded if symptoms had persisted beyond five days and/or if a palpable right-lower

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-quadrant mass suggestive of an appendicular abscess was present, warranting management with antibiotics with or without percutaneous drainage. Additional exclusion criteria included a history of cirrhosis or coagulation disorders, generalized peritonitis, hemodynamic shock at presentation, absolute contraindications to laparoscopic surgery (large ventral hernia, prior laparotomy for small-bowel obstruction, or ascites with abdominal distension), contraindications to general anaesthesia (severe cardiac or pulmonary disease), inability to provide informed consent owing to mental incapacity, and pregnancy.

Randomization: Eligible patients were counselled regarding the risks and benefits associated with each surgical approach and were asked to provide written informed consent in their preferred language, using a form approved by the institutional ethics committee. Prior to randomization, baseline assessment was carried out for two parameters: pain, using a visual analogue scale (VAS), and physical activity, using a structured activity-scoring instrument.

Surgical Technique: All patients received intravenous ceftriaxone (1 g every 12 hours) from the time of diagnosis until surgery. Patients in whom intraoperative findings revealed complicated appendicitis (gangrenous or perforated) were managed with triple antibiotic therapy — ceftriaxone, amikacin, and metronidazole — continued until the white blood cell count normalized and the patient remained afebrile (below 37.9°C) for 24 hours. All patients received a single postoperative antibiotic dose, and none required urinary catheterization.

In the open group, a McBurney muscle-splitting incision approximately one inch in length was made in the right lower quadrant. The appendicular stump was doubly ligated with absorbable suture. Where the appendix appeared macroscopically normal, it was nonetheless removed, and the distal ileum was inspected to exclude a Meckel's diverticulum. The peritoneal cavity was irrigated with warm saline, and the skin was closed with 3-0 monofilament polyamide sutures; in cases of perforation, the wound was closed loosely.

The laparoscopic procedure was performed using a three-port technique, with the laparoscope introduced through a 10-mm umbilical port and two additional 5-mm ports placed in the left iliac fossa and suprapubic region. The abdominal cavity was systematically explored to locate the appendix and exclude alternative pathology. The appendix and mesoappendix were divided using bipolar coagulation, and the right paracolic gutter and, where purulence was noted, the subhepatic space were irrigated and suctioned. The specimen was retrieved within a laparoscopic bag, fascial defects at the port sites were closed with 0-Vicryl sutures, and skin incisions were closed with 3-0 monofilament polyamide. A non-suction drain was placed in cases with an associated abscess.

Postoperative Care: A standardized protocol was followed for reintroduction of oral intake. Bowel sounds were assessed every six hours, and once present, patients were started on clear liquids before progressing to a regular diet once liquids were tolerated and flatus was passed. Patients were discharged once a regular diet was tolerated.

Outcome Measures: The following parameters were documented for each patient: anaesthesia time (from induction to reversal) and operating time (skin to skin), postoperative complications — with intra-abdominal abscess defined by fever and leukocytosis confirmed on computed tomography, and wound infection defined as erythema and discharge necessitating opening and packing of the wound — histopathological findings (classified as acute, gangrenous, or perforated appendicitis), time to resumption of clear liquid and regular diet, and duration of hospital stay.

Physical activity was assessed daily using a ten-item Activity Assessment Scale encompassing tasks such as lying in bed, sitting, transferring, indoor and outdoor ambulation, sedentary and light-to-vigorous physical activity, and sexual activity, each scored from 1 (no difficulty) to 5 (unable to perform), with higher cumulative scores reflecting poorer functional activity. Postoperative pain was measured using a visual numeric analogue scale ranging from 0 (no pain) to 10 (worst imaginable pain). At the two-week follow-up visit, patients were re-examined in the wound clinic for evidence of wound infection, intra-abdominal abscess, or any other complication.

RESULTS

Of 268 patients initially randomized to either the laparoscopic or open arm, 18 were subsequently excluded (15 declined their allotted treatment and 3 were found to be pregnant), leaving 250 patients available for final analysis.

Demographic Profile: The two treatment groups were comparable with respect to age, sex distribution, and preoperative white cell count.

Morbidity: No deaths were recorded in either arm. The overall complication rate did not differ significantly between the laparoscopic (17.5%) and open (16.1%) groups (P = 1.00). Two major complications in the laparoscopic group required reoperation — postoperative haemorrhage from injury to the inferior epigastric artery at the left-iliac-fossa trocar site, and bleeding from the appendicular artery — both of which resolved without further sequelae. No complication in the open group required reoperation.

Infectious complications were similar between the two arms, with seven wound infections and six intra-abdominal abscesses in the laparoscopic group compared with nine wound infections and four intra-abdominal abscesses in the open group. Wound infection rates (6.2% versus 6.7%; P = 1.00) and intra-abdominal abscess rates (5.3% versus 3%; P = 0.51) did not differ significantly between the laparoscopic and open groups, respectively.

Clinical Outcomes: Both operative time and total anaesthesia time were significantly longer in the laparoscopic group. Conversion to an open procedure was required in nine patients (8%) originally assigned to the laparoscopic arm, most commonly owing to unclear anatomy or difficult dissection (8 patients), with failure to achieve pneumoperitoneum accounting for the remaining case. No significant difference was noted between the groups in the time to resumption of liquid or solid diet, and the overall duration of hospitalization was comparable. Ninety percent of patients (225 of 250) were discharged on or before the third postoperative day.

Histopathology: Histopathological examination identified five normal appendices (1 open, 4 laparoscopic), 155 cases of acute appendicitis (82 open, 73 laparoscopic), and 90 cases of complicated appendicitis with gangrene or perforation (47 open, 43 laparoscopic), with no significant difference in distribution between the two techniques (P = 0.153). Complication rates for both acute and complicated appendicitis were statistically similar regardless of the surgical approach used (P = 0.181).

Postoperative Pain: Baseline pain severity and its impact on activity were comparable between the two groups prior to surgery. Postoperatively, pain severity remained similar on days 1, 2, and 3 and at the two-week follow-up, and there was no significant difference in narcotic or oral analgesic requirement between the groups. The influence of pain on daily activities followed a similar pattern throughout the postoperative period in both arms.

Physical Activity: No significant difference was observed between the groups with respect to the performance of routine daily activities, or the degree to which surgery limited such activities, on postoperative days 1, 2, and 3 and at the two-week assessment.

Quality of Life: Quality-of-life outcomes did not differ significantly between the laparoscopic and open groups.

DISCUSSİON

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CONCLUSION

This prospective randomized comparison found no mortality in either arm and a broadly similar overall complication rate between the laparoscopic and open groups (17.5% versus 16%, respectively), although a small subset of early laparoscopic complications required reoperation. The laparoscopic technique was associated with a significantly longer operating time (60 minutes versus 40 minutes; P = 0.000), while pain scores, analgesic use, time to resumption of diet, length of hospital stay, and activity scores were statistically equivalent between the two approaches, including at the two-week follow-up. Complication rates for acute as well as complicated appendicitis were similar irrespective of technique (P = 0.181). Unlike several other minimally invasive procedures, laparoscopic appendicectomy did not translate into a consistent clinical advantage over the open technique across the parameters evaluated, apart from quality-of-life scores at two weeks, and it required a longer duration of surgery. These findings suggest that the choice between laparoscopic and open appendicectomy may reasonably be individualized according to surgeon experience and patient preference rather than dictated by a demonstrable superiority of either technique.

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