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Research Article

Laparoscopic versus open appendicectomy: a comparative study

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ABSTRACT

Background: Acute appendicitis is one of the common emergency surgical problems that usually we encounters. Since its introduction by McBurney in 1894, appendicectomy has been the treatment of choice for acute appendicitis. Since its initial description by Semm in 19834, Laparoscopic appendicectomy (LA) has struggled to prove its superiority over the open technique. The advantages of LA over open appendicectomy (OA) are thought to be less postoperative pain, shorter hospital stay and early return to usual activity. While the incidence of postoperative wound infection is thought to be lower after the laparoscopic technique. There is however notions showing only minimal benefit from laparoscopic appendicectomy, with higher cost of this method. Though multiple prospective randomized trials, meta-analyses, and systematic reviews have been conducted to assess the value of LA over OA, the heterogeneity of the measured variables and other weaknesses in methodology have not allowed drawing definitive conclusions and generalizations.
Methods: It is a prospective study comparing the advantage of laparoscopic over open appendicectomy.
Results: The mean duration of hospital stay in both the study groups (OA and LA) 3.5 and 3.4 respectively. There was no significant return of bowel sounds, return to normal activity and surgical site infection. But cost for to be high with laparoscopic appendicectomy.
Conclusions: There was no advantage of laparoscopic appendicectomy over open appendicectomy in terms of return of bowel sounds, return to normal activity and surgical site infection. But cost for to be high with lap appendectomy. To conclude, LA has no definite advantages over OA as per results of my study.

Keywords: Acute appendicitis, Laparoscopic appendicectomy, Open appendicectomy, Pelvic abscess, Quality of life

INTRODUCTION

In the last decade laparoscopy has significantly affected general surgical procedures for a variety of pathological indications. With accumulation of experience and progress in armamentarium technology the number and types of procedures routinely performed with minimally invasive technique has grown. Laparoscopy is more often applied not only in elective surgery, but also in emergency surgeries. Suspected appendicitis is undoubtedly the most common indication for emergency surgical intervention, with a lifetime risk of 6%.[1,2] Since its introduction by McBurney in 1894, appendicectomy has been the treatment of choice for acute appendicitis3. Since its initial description by Semm in 19834, Laparoscopic appendicectomy (LA) has struggled to prove its superiority over the open technique. This is in contrast to laparoscopic cholecystectomy, which has promptly become the gold standard for gallstone disease.[3] Open appendicectomy (OA) has withstood the test of time for more than a century. The procedure is standardized among surgeons and unlike

cholecystectomy, OA is typically completed using a small right lower quadrant incision and postoperative recovery is usually uneventful.

The advantages of LA over OA are thought to be less postoperative pain, shorter hospital stay and early return to usual activity.[4,5] While the incidence of postoperative wound infection is thought to be lower after the laparoscopic technique, the incidence of postoperative intra-abdominal sepsis may be higher in patients operated on for gangrenous or perforated appendicitis.[4,5] There are however notions showing only minimal benefit from laparoscopic appendicectomy, with higher cost of this method.

However conversion to open surgery is inevitable in some cases. The conversion causes prolongation of hospital stay, increased total cost and dissatisfaction of the patients. The most valuable aspect of laparoscopy in the management of suspected appendicitis is as a diagnostic tool, particularly in women of child-bearing age8. Though multiple prospective randomized trials, meta-analyses[6-9] and systematic reviews[10-13] have been conducted to assess the value of LA over OA, the heterogeneity of the measured variables and other weaknesses in methodology have not allowed to draw definitive conclusions and generalizations.[12-13] Hence, the 'gold standard' modality of treatment for clinically confirmed appendicitis is still not established. Unfortunately, there are not many authoritative studies comparing the results of LA with OA in our locality. Hence the need for this study.

Objectives

To compare laparoscopic appendicectomy versus open appendicectomy in terms of hospital stay, post operative analgesia, post operative recovery, return to work.

METHODS

All cases of appendicitis operated from January 2013 to January 2014 in the Department of Surgery in our hospital 'Clinically confirmed' case of appendicitis means an Alvarado score of 7 or more or an equivocal score (5-6) with sonological evidence. Both emergency and elective cases were included in the study

Inclusion criteria

- The new patients of both sexes belonging to age group 5-50 years presenting with acute appendicitis.
- Emergency as well as elective cases were included.

Exclusion criteria

- Patients with delayed presentation leading to appendicular mass.
- Patient not willing to participate in the study.
- All cases of LA converted to OA were excluded from comparison with OA.

RESULTS

A total of 187 patients were included in the study during this period, according to the inclusion criteria. Of this 100 patients underwent an open appendicectomy, 87 underwent a laparoscopic appendicectomy, and 13 patients were converted from an LA to OA. These 13 patients were excluded from analyzing the primary outcome measures. post operative pain, post operative recovery, duration of hospital stay, wound infection (surgical site infection) , cost analysis and time to return to usual activities. Out of the total 187 patients, there were 88 males and 99 females. The mean age of the study population was 24.1 years (Range: 5-55 years).

Duration of hospital stay

The mean duration of hospital stay in both the study groups (OA and LA) 3.5 and 3.4 respectively. There was no significant difference in number of patients who stayed for 3 or 4 days in hospital between OA and LA, but among the group of patients who satyed for more than 5 days 69% belong to open appendicectomy group (Table 1 & 2; Figure 1).

Table 1: Distribution according to hospital stay.

	Open appendicectomy	LAP appendicectomy
Mean	3.5	3.4
Std Deviation	0.8	0.7
Median	3.0	3.0
Minimum	3.0	3.0
Maximum	6.0	6.0

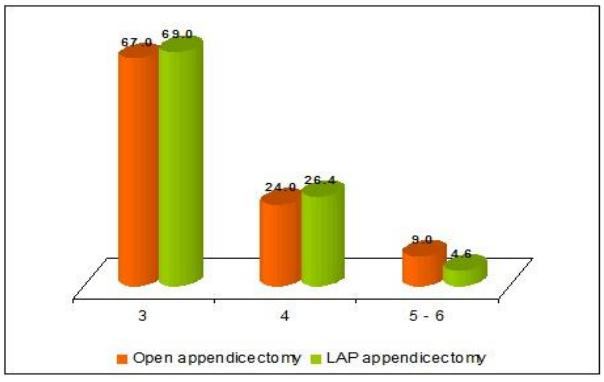

Figure 1: Comparison of hospital stay based on type of procedure.

Post operative analgesia in the study groups

There was no significant difference in the post operative analgesia requirement between the 2 groups (p – 0.7). The mean analgesic requirement was 6.5 ± 0.8 doses in

the OA group and 6.5 ± 0.6 in the LA group (Table 3 & Figure 2).

Table 2: Comparison of hospital stay based on type of procedure.

Hospital stay	Open appendicectomy		LAP appendicectomy	
	Count	Percent	Count	Percent
3	67	67.0	60	69.0
4	24	24.0	23	26.4
5 - 6	9	9.0	4	4.6
Mean ± SD	3.5 ± 0.8		3.4 ± 0.7	

Table 3: Comparison of post op analgesia based on type of procedure.

Analgesia	Open appendicectomy		LAP appendicectomy	
Post OP	Count	Percent	Count	Percent
5-6	57	57.0	46	52.9
7-8	41	41.0	41	47.1
9-10	2	2.0	0	0.0
Mean ± SD	6.5 ± 0.8		6.5 ± 0.6	

t= 0.28; p= 0.781

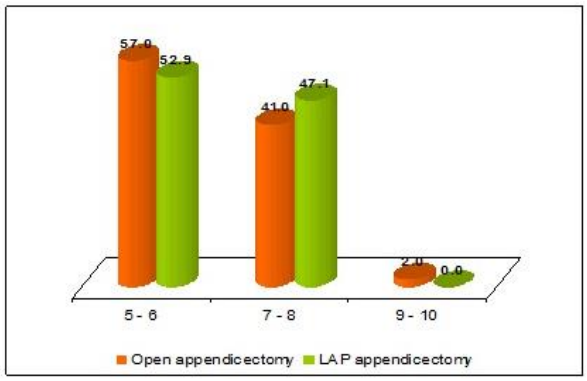

Figure 2: Comparison of post operative based on type of procedure.

Return of bowel sounds

70% of the patients in OA group and 77 % in LA group had return of bowel sounds in first postoperative day (at 24 hours) and remaining 30 and 23% in 2nd post operative day (at 48 hours) No statistical significance in return of bowel sounds was noticed in the 2 study groups (Table 4 & Figure 3).

Return to normal activity

Majority of the patients in OA and LA group had return to normal activity by 7th post operative day (54% and 56.3%) . there was no statistical significance in return to normal activity between the 2 study groups (Table 5 & Figure 4).

Table 4: Comparison of type of procedure based on return bowel sounds.

Return bowel sounds	Open appendicectomy		LAP appendicectomy		χ^2	P
	Count	Percent	Count	Percent		
First post operative day	70	70.0	67	77.0	1.17	0.280
Second post operative day	30	30.0	20	23.0		

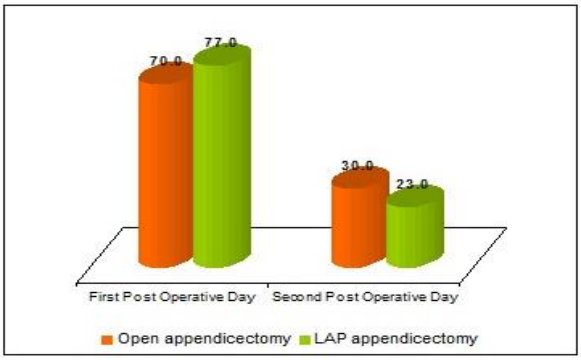

Figure 3: Comparison of type of procedure based on return bowel sounds.

Table 5: Comparison of type of procedure based on return to normal activity.

Return bowel normal activity	Open appendicectomy		LAP appendicectomy		χ^2	P
	Count	Percent	Count	Percent		
6	7	7.0	10	11.5	2.23	0.526
7	54	54.0	49	56.3		
8	34	34.0	26	29.9		
9	5	5.0	2	2.3		

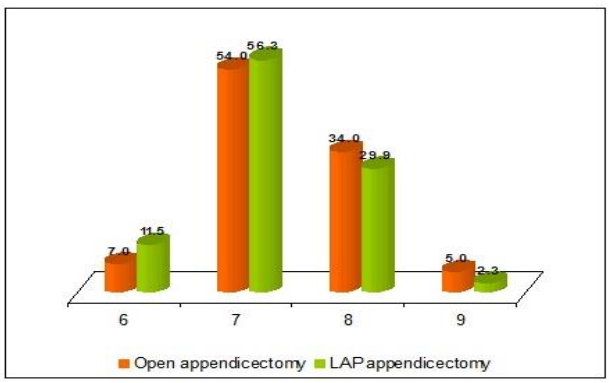

Figure 4: Comparison of type of procedure based on return to normal activity.

Surgical site infection

When surgical site infection was compared between the 2 study groups there was 6 cases of surgical site infection in OA group and 2 cases in LA group,no statistical significance in surgical site infection between the 2 study groups (Table 6 & Figure 5).

Table 6: Comparison of type of procedure based on surgical site infection.

surgical site infection	Open appendicectomy		LAP appendicectomy		χ^2	P
	Count	Percent	Count	Percent		
No	94	94.0	85	97.7	1.56	0.212

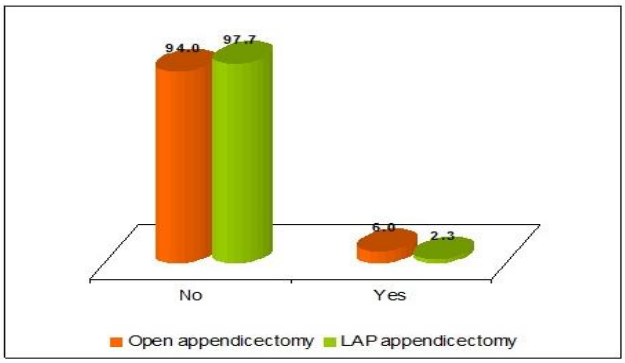

Figure 5: Comparison of type of procedure based on surgical site infection.

Cost

When cost between the 2 studies groups were compared mean in OA group was 9160.8 and LA was 13676.3. Lap appendicectomy costs more than open appendicectomy (Table 7).

Table 7: Distribution according to cost.

	Open appendicectomy	LAP Appendicectomy
Mean	9106.8	13676.3
Std Deviation	1875.6	1259.1
Median	8600.0	13600.0
Minimum	7100.0	12100.0
Maximum	10000.0	17880.0

DISCUSSION

Results of previous studies

Numerous prospective randomized trials,[14-16] meta-analyses,[6-9] and systematic critical reviews[10-13] have been conducted to assess the value of LA over OA, but there is some variability in the results of these studies.[17] The overall mortality of OA is around 0.3%; and morbidity around 11%.[18] Given the large number of procedures done annually, the validation of a minimally invasive technique that would improve outcomes may have a direct impact on patient management and possibly an indirect effect on the economics of health care.[17]

In an article published in Ann Surg 2005, Katkhouda et al performed an extensive search of literature comparing LA to OA in adults using the review of Cochrane Central Registry of controlled trials, MEDLINE, and Sci Search. 45 prospective randomized studies, 4 meta analyses, 4 systematic reviews (including 1 cochrane database) and 4 large non randomized comparative trials were included in the review.[17]

As suggested by all meta- analyses and systematic reviews, the methodological quality of most studies was "poor to moderate". Only 7 PRS had a sample size of 200 patients or more. The majority of non randomized studies favored laparoscopy. These should be analysed with caution because of their inherent bias.

In 1993, Tate et al from Hong Kong published data collected on the initial 55patients 6 months after the introduction of LA in their hospital, that were compared to 100 OA42. They found significant benefits in favour of LA. These same authors in a follow up PRS conducted in the same institution concluded that their study could "no longer support the widespread adoption of a laparoscopic alternative to a traditional operation based on initial uncontrolled studies".[14]

Two studies from Sweden and Denmark that included 500 and 583 patients, respectively followed sound scientific principles,[19-20] but the lack of appropriate blinding and inclusion of multiple centres weakened the results.

Review of outcomes

The overall reported mortality of appendectomy is very low and was estimated in a review of large administrative database at 0.05% for LA and 0.3% for OA,[18] reinforcing the fact that appendicectomy in the absence of peritonitis is a safe procedure, regardless of the technique.

Overall complication rates were similar in both groups in most of the studies. The most serious early complication in the LA group, that required a reoperation is injury of the epigastric vessels due to an inadequate trocar placement, and is avoidable with the placement of trocars under direct vision lateral to the epigastric arteries.[17] The removal of all cannulas should also be done under direct vision prior to releasing of the pneumoperitoneum to detect any subtle bleeding from the abdominal wall. Infectious complications like wound infection and intra abdominal abscesses are two variables by which the techniques have been traditionally compared. However most studies demonstrated reduced wound infection rate for LA. On the other hand, Klingler et al[21] and Katkhouda

et al[17] found that infectious complications were similar in both groups. The incidence of intra abdominal abscess formation was slightly higher in the laparoscopic group.[11-13] It is possible to reduce this if the sigmoid colon is retracted, the patient is placed in trendelenburg, and the pelvis is completely irrigated and aspirated under direct vision.[22]

The operating room time, in most of the previous studies was longer for the LA group, despite the subjective perception that it can be an easier operation.[10-12] This may be due to the inclusion of additional steps for set up, insufflation, trocar entry under direct vision, and diagnostic laparoscopy.

Pain assessment can be done in two ways: Subjectively by the visual analogue scale and objectively by the tabulation of pain medications. The literature is divided on this subject. Some studies show less pain in the first two days after LA.[6-9] All but one of these studies were non-blinded, thus reducing the validityof the results.[16,23]

The question of whether LA decreases the length of hospitalization has been a matter of debate over the past decade.[18-24] The literature provides contradictory results. Although some recent retrospective cohort studies or chart reviews found LA associated with significantly shorter hospital stay,[25-28] other retrospective investigations reported non-significant differences.[29-30] Similarly some RCT associated LA with decreased hospital stay; however others report no significant differences. Even meta-analyses report controversial findings. Sauerland and associates summarized the results of 28 RCT and almost 3000 patients and reported a significant decrease in length of hospital stay in LA group.[9] Similar results were found by Golub and colleagues,[10] whereas another meta-analysis failed to show a statistically significant difference.[7] The current literature describes that the difference may be affected by hospital factors or social habits. Moreover further discrepancies may arise from diverse health care policies and insurance systems in different countries.

The return to normal activity following appendicectomy is also a subject of debate. A minimally invasive operation by definition should allow for a quicker recovery, shorter convalescence at home, and quicker return to work. Several studies found LA to be associated with significantly earlier return to normal activities compared to OA. The results of a prospective RCT by Katkhouda and colleagues, based on the use of an objective instrument to measure the activity showed no difference in scores post operatively and at 2 weeks.[17] Others found improved postoperative activity in the LA group. But the comparison among the studies is difficult because of the variable definitions of activity. Results in 4 meta-analyses were statistically "highly heterogenous".[6-9] In contrast, Ignacio et al[23] carried out a blinded prospective study in a tertiary care military based hospital on healthy active-duty men. This specific cohort was selected because the mandatory documentation required for convalescence in the military, made for accurate assessment of lost days. In this study there was no difference in pain on days 1 and 7 postoperatively or in the time to return to work.[23]

It has been previously reported that the presence of appendiceal perforation or abscess is associated with poorer outcome.[26] Most studies, however, didn't stratify the findings by the presence of abscess or perforation. In a large retrospective study, stratified analyses were performed for patients with or without perforation.[26] The average length of hospital stay was significantly shorter for LA patients with or without perforation. Similar results were reported by Hebebrand et al[31] from Germany. In an administrative database conducted by Ulrich and associates, median length of hospital stay was shorter regardless of whether abscess or perforation was present but, in- hospital infections were significantly lower in the subset of LA patients without abscess or perforation.

The assessment of quality of life using the SF-36, by Katkhouda et al[17] showed improved scores in the LA group for 3 of the 8 parameters, namely physical functioning, general health, physical health, and in the general score.

Gynaecological diseases are common causes of acute abdominal symptoms, in childbearing women. Laparoscopy makes definite determination of intra abdominal pathology possible and allows for avoidance of unnecessary laparotomy and risk of adhesions, which can be a cause of intestinal obstruction or infertility in long term observation. But diagnostic laparoscopy was not included in our study.

Results of present study

In our study conducted at our hospital during a period from January 2013 to January 2014, 200 patients underwent appendicectomy, of which 100 patients chose for laparoscopic surgery. As 13 out of this had to be converted to open surgery, finally 87cases of LA were compared with 100 cases of OA. There was no mortality in either group.

The mean age of the patient population was 24.1 years. Majority of females chose an LA (70.1%), while majority of males (62 %) chose for an OA. Certain medical conditions like bronchial asthma, COPD, and cardiac diseases where general anaesthesia is considered risky, also influenced the decision making. The direct cost involved in an LA was definitely higher than that in OA, and hence some economically backward class of patients could not afford an LA.

There was no significant difference in incidence of wound infection between the two groups. The incidence of intra-abdominal abscess which is thought to be more in

the LA group as per some previous studies was not analysed in my study.

Duration of hospital stay was similar in both the study groups and there are contradictory reports in different studies, with similar as well as opposite results.

The duration of return of bowel sounds and return to normal activities were compared between the two groups .But there was no statistically significant difference in either of these parameters.

CONCLUSION

Appendicectomy in uncomplicated acute appendicitis is a safe procedure, regardless of the technique performed.

- OA is a time-tested procedure, with a small incision and minimal morbidity.
- Epidemiologically there was no significant difference in selection of procedure between different age, but there was a definite preference for laparoscopic appendicectomy among the female population.
- Laparoscopic appendicectomy has no definite advantages over its open counterpart, in terms of postoperative analgesic requirement, duration of hospital stay, time to return of bowel sounds, time to return to normal activities.
- There is no significant difference in wound infection between the two groups.
- Cost was definitely higher for the laparoscopic procedure over the open procedure in my study setting which was a factor against choosing LA.
- To conclude, LA has no definite advantages over OA as per results of my study.

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