Laparoscopic appendicectomy versus open appendicectomy: a comparative study of clinical outcome and cost analysis – Institutional experience

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Abstract

Background Laparoscopic appendicectomy had not gained importance against open appendicectomy and it remains controversial in Indian perspective.

Aim Compare the clinical outcome and cost effectiveness of Laparoscopic Appendicectomy (LA) versus Open Appendicectomy (OA).

Methods A prospective study for a period of 21 months from Oct. 2005 to June 2007, 249 patients underwent appendicectomy and 200 patients were included in the study. 114 underwent Open appendicectomy and 86 underwent laparoscopic appendicectomy. Duration of surgery, postoperative complications, postoperative hospital stay, postoperative pain and requirement of analgesia, resumption of oral feeds, cost of hospital stay and return to normal activities was compared and noted.

Result Laparoscopic appendicectomy was better than open appendicectomy with respect to the wound infection rate, early resumption of oral feeds, postoperative pain, lesser use of analgesics, postoperative hospital stay (3.13 days after LA, 4.36 days after OA, $P < 0.0001$) and return to normal activities (LA group to OA group; 13.86 days

to 19.44 days $P < 0.0001$). Although above mentioned advantages were at the cost of slightly increased duration of surgery (58.29 min in OA group to 74.13 min in LA group $P < 0.0001$ HS) and cost of surgery {LA: OA Rs.4225.81: Rs.5560.92 ($P < 0.0001$)}.

Conclusion Laparoscopic appendicectomy was better than open appendicectomy with respect to wound infection rate, early resumption of oral feeds, postoperative pain, lesser use of analgesics, postoperative hospital stay and return to normal activities. Although above mentioned advantages were at the cost of slightly increased duration of surgery and cost of surgery.

Keywords Appendicectomy · Laparoscopy · Surgery

Introduction

The treatment of acute appendicitis remained essentially unchanged since its first description by Charles McBurney in 1889 before the New York Surgical Society [1].

Appendicectomy by McBurney's incision remained the procedure of choice for nearly a century until 1983 when Kurt Semm offered an alternative, "laparoscopic appendicectomy" [1, 2]. But as McBurney's operation is well tolerated with less co-morbidity the benefits of laparoscopic appendicectomy have been difficult to establish [2]. The putative advantages of the laparoscopic approach are quicker and less painful recovery, fewer postoperative complications and better cosmesis [3].

It allows better assessment of other intra-abdominal pathologies. But, because the validity of these points remains unconvincing and also because of shortage of laparoscopic

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sets in some hospitals, laparoscopic appendicectomy is not practiced widely [3]. Twenty years later laparoscopic appendicectomy is all set to become the choice of therapeutic modality [3]. This prospective comparative study was done to highlight the advantages of this procedure and proves it to be superior over open appendicectomy [3].

Patients and methods

A Prospective study done for a period of 21 months from 1st October 2005 to 30th June 2007; Department of Surgery, Kasturba hospital, Manipal. All patients operated for Acute appendicitis and patients who underwent interval appendicectomy were included in the study. Patient diagnosed to have appendicular mass or appendicular abscess either clinically/ultrasound abdomen/intraoperatively were excluded from the study. Patients intra operatively diagnosed to have perforated appendix and intra abdominal abscess were excluded from the study. Patients who underwent any other surgery with appendicectomy (Laparoscopic/ Open) were excluded from the study.

Patients having any co morbid illness like Tuberculosis, diabetes mellitus, hypertension, bronchial asthma, ischemic heart disease and evaluated for the above diseases were excluded from the study. Patients with ASA category 3, 4 and 5 were excluded. Patients converted from Laparoscopic Appendicectomy/Open Appendicectomy were considered separately and excluded from the study.

Choice of surgery was left to the discretion of the patient and surgeon. All patients were investigated where blood counts, renal parameters and ultrasound abdomen was done. All patients receiving pre-operative antibiotics and post-operative antibiotics were left to the discretion of the surgeon. Operative time was calculated from the incision to complete closure of the wound. Open appendicectomy group underwent through a McBurneys or Lanz's incision. Laparoscopic Appendicectomy group was done using a standard 3 trocar approach. Pneumoperitoneum with Veres or Direct trocar was noted. Sutures used for appendicular stump -Intra corporeal knotting or extra corporeal knotting or using staplers or clips. Retrieval of the specimen through which port was noted.

Intraoperative findings like adhesions, free fluid, dilation, congestion and contents were noted. Position of the appendix was noted. Complications intra-operatively and post-operatively were noted. Determination of length of hospital stay and complications intra-operatively and post-operatively were noted. Post-operative course was monitored for duration of hospital stay in days. Postoperative analgesics which were given were calculated with the number of doses given (Intravenous and Oral). Post-operative pain was assessed daily through out the patient hospital stay by using a Visual analog scoring system.

Cost analysis was obtained from hospital billing records. Hospital charges represented the sum of all charges assessed to the patient during their hospitalization. Daily charge represents the fee assessed for bed occupancy, operating room charges (including fees for total time in the operating room and all equipment charges). All Professional charges were deducted. During the follow-up patient was assessed from the hospital records, communicating over telephone or letter for surgical site infection and pain at the surgical site. Recovery time from returning to the normal activities was also noted.

Results

Two hundred forty nine patients underwent surgery for appendicectomy. Two hundred patients were included in the study of which eighty six patients underwent laparoscopic appendicectomy (43%) while one hundred fourteen patients underwent open appendicectomy (57%). Fourty-nine patients were excluded from the study. Exclusion groups included 26 from OA group, and 16 from LA group. In 7 patients, Laparoscopy was converted to open appendicectomy. 10 patients had perforated appendix, 11 underwent two surgeries and 41 had comorbid illness and was excluded from the study. Patients were diagnosed to have Acute appendicitis in 118 and Interval group 82. Majority of the patient were in the below 25 yrs constituting 116 patients (58%). Patients were on average 27.18-years-old and ranged from 15 years to 73 years. Mean age for male was 27.7 yrs with the range from 16 yrs to 73 yrs and mean age for female was 26.60 yrs with the range from 15 yrs to 60 yrs ($p=0.391NS$). Patients who underwent OA were older (LA: 26.09 years, OA: 28 years) and more likely female in LA group (49.5% female, 36% male) and male in OA group (63.6% male, 50.5% female). However it was not statistically significant. The mean duration of surgery in open appendicectomy was 58.29 min as compared to 74.13 min in laparoscopic group, which is highly significant ($p=0.0001HS$). The most position of the appendix was retrocaecal (37.5%) noted in the study. Intraoperative findings were noted during the procedure and majority had congested and inflamed appendix (83.5%) and distended (36%). In the OA group, majority underwent through a Lanz's incision 59 patients to McBurney incision in 55 patients. 65 patients the stump was buried and 49 patients the stump was transfixed. In LA group, 53 patients underwent Extracorporeal ligation and 33 patients underwent Intracorporeal ligation. There was significant difference in the duration of time in extracorporeal versus Intracorporeal ligation (74.53 min to 73.48 min) $p=0.0001HS$.

Only 2 patients had injury to the bowel in LA group. No uncontrolled bleeding was present. No intra operative complications were encountered in the OA group. Most common complication noted in the postoperative period was

surgical site infection (SSI). It was more common in the OA group (11 patients- 9.6%) to no surgical site infection in the LA group ($p<0.0001$ HS). Ileus was the other complication noted in our study groups with 14 patients (OA- 10{8.8%}, LA- 4{4.7%}). Postoperative recovery was noted in early starting of oral feeds, Postoperative pain and postoperative analgesics. Early starting of oral feeds was noted in LA group (15.14 hrs) to OA group (24.48 hrs) which was highly significant ($p<0.0001$ HS). Postoperative pain was assessed by Visual analog scale (VAS) in relation to the activity of the patient during rest, normal daily activities and exercise and strenuous work. The pain scoring was less in LA group compared to OA group (day 1- 6.93 to 5.88; day 2- 5.28 to 3.77; day 3- 4.2 to 3.04; day 4- 3.75 to 2.95) $p<0.0001$ HS, Fig. 1.

Postoperative analgesics requirement was also studied. Diclofenac was the analgesic given to all patients. LA group required less (3.31 IV doses and 2.85 oral doses) doses to OA group (7.05 IV doses and 4.53 oral doses) which was highly significant ($p<0.0001$) Table 1.

Length of hospital stay ranged from 2 days to 10 days. The length of stay was significantly shorter after LA (3.13 days after LA, 4.36 days after OA, $P<0.0001$). The operative cost of laparoscopic appendicectomy was greater (LA: OA Rs.4225.81: Rs.5560.92) compared to open appendicectomy which was highly significant ($p<0.0001$). Late complications noted in the study were more with OA group to LA group (7 to 2 patients). In OA group, 3 patients had SSI, 2 had Sub acute intestinal obstruction, 1 patient had ad-

hesions (noted on diagnostic laparoscopy for ovarian cyst), 1 had intra abdominal abscess. In LA group, 1 patient had SSI and 1 patient had umbilical sinus. In LA group, return to normal activities (13.86 days to 19.44 days) was earlier as compared to the OA group which was highly significant ($p<0.0001$). Histopathology revealed normal appendix in 5 patients in the LA group and 8 patients in the OA group. For the other patients in both the groups histopathology was suggestive of acute appendicitis (Table 2).

Discussion

The results of the present study are in keeping with several previous studies where laparoscopic appendicectomy has been shown to be both feasible and safe in comparison with open appendicectomy [1–12, 15, 19, 20, 25, 26]. The advantages and disadvantages of open and laparoscopic appendicectomy was measured in terms of duration of time, intraoperative and postoperative complications, postoperative recovery, postoperative pain, analgesics requirement, postoperative hospital stay, cost analysis and recovery to normal activities. In the present study more operating time was noted for laparoscopic appendicectomy (74.13 min LA / 58.26 min OA $p<0.0001$ HS). This was because of the learning curve, level of surgical experience and patient selection accounted for increased operative time. [2–4, 6, 7] Significant variation in operating time was noted in various controlled studies. Some studies noted a shorter operating

Fig. 1 Bar-graphs showing pain scoring

Table 1 Postoperative analgesics in doses

Analgesics	Groups	Mean	P value(<0.05)
IV doses	OA	7.05	0.0001HS
	LA	3.31	
Oral doses	OA	4.53	0.0001HS
	LA	2.85	

time for patients undergoing open appendicectomy while others revealed no difference. However laparoscopic appendicectomy is time consuming. It is also argued that the advantages of laparoscopic appendicectomy are marginal compared to open appendicectomy performed by an experienced surgeon through a short, cosmetically acceptable incision with minimal complication and shorter hospital stay. [34, 25, 26, 28]

Table 2 Comparative results in the study groups

N- 200	LA group (n- 86)	OA group (n-114)	P value(<0.05)
Mean duration of surgery in minutes	74.13	58.29	<0.0001
Surgical site infection	0	11 (9.6%)	<0.0001
Starting of oral feeds	15.14 hrs	24.48hrs	<0.0001
Length of hospital stay	3.13 days	4.36 days	<0.0001
Cost of surgery	Rs. 5560.92	Rs. 4225.81	<0.0001
Return to normal activities	13.86 days	19.44 days	<0.0001

Laparoscopic appendectomy confers advantages in terms of fewer wound infections [4–10], less pain, faster recovery and earlier return to work. In accordance with other studies there were significantly fewer wound infections in the laparoscopy group. A reduction in wound infection can be achieved by extraction of the specimen through a port or with the use of an endobag, or leaving a non-inflamed appendix in place. This has been confirmed in the present study. Postoperative recovery, oral feeds were resumed after surgery on an average of 24.48 in open group to 15.14 hours in laparoscopic group ($p=0.0001$ HS). Similar observations were noted in the other studies also [5, 6].

The question of whether laparoscopic appendectomy decreases the length of hospitalization has been a matter of great debate over the past decade. Postoperative stay was significantly more in open appendectomy group when compared to laparoscopic appendectomy group (OA: 4.36 days, LA: 3.13 days; $P=0.0001$) in the present study. The literature provides contradictory results.[6, 7, 16–18, 22, 25] Most studies report a median hospital stay of 2–5 days irrespective of laparoscopic or open procedure. Sauerland and associates [24] summarized the results of 28 randomized controlled trials and almost 3000 patients and reported a significant decrease in length of hospital stay in patients undergoing LA. Similar results were found by Golub and colleagues [25], whereas another meta-analysis failed to show a statistically significant difference in length of hospital stay between LA and OA [15, 26–28]. The heterogeneity of published results regarding length of hospital stay may be caused by a variety of factors. The current literature describes that the difference may be affected by hospital factors or social habits, rather than reflecting differences resulting from the operative technique itself. The present study revealed a significantly shorter hospital stay for patients undergoing laparoscopic appendectomy.

At a glance the mean operative cost of laparoscopic appendectomy seems to be greater compared to open appendectomy in the present study (LA: Rs 5560.92, OA: Rs 4225.81) which was highly significant($p=0.0001$). But considering the total cost of the disease when cost of accommodation, operation and duration of time, daily cost of inpatient stay, hourly cost of operating room and the patients consumption is taken into account laparoscopic appendi-

ectomy provides a clinical comfort in all patients.[4–6, 8, 15–16, 18, 25–28]. Return to normal activities was more in open group as compared to in the laparoscopic group (OA: 19.44 days, OA: 13.86 days; $p=0.0001$ HS) was shown in the present study. Pendersen AG et.al reported the median time to return to normal activity as 7 days in laparoscopic group to 10 days in open group. Others have also shown that laparoscopic group patients returned to normal work earlier. Because of the competition of laparoscopic and open appendectomy, open appendectomy has improved greatly. More and more questions are being raised as to the benefit of laparoscopic appendectomy. A few recent randomized controlled trials have even gone to the extent questioning the benefits and efficacy of laparoscopic appendectomy. Some authors have concluded once and for all that laparoscopic appendectomy is out.

Conclusion

On analyzing the data, we have found a definite difference in outcome between open appendectomy and laparoscopic appendectomy in our study. Laparoscopic appendectomy was better than open appendectomy with respect to wound infection rate, early resumption of oral feeds, postoperative pain, lesser use of analgesics, postoperative hospital stay and return to normal activities. Although above mentioned advantages were at the cost of slightly increased duration of surgery and cost of surgery. But going by our study we definitely find an over all advantage of laparoscopic appendectomy.

Conflict of interest The authors do not have any disclosable interest

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